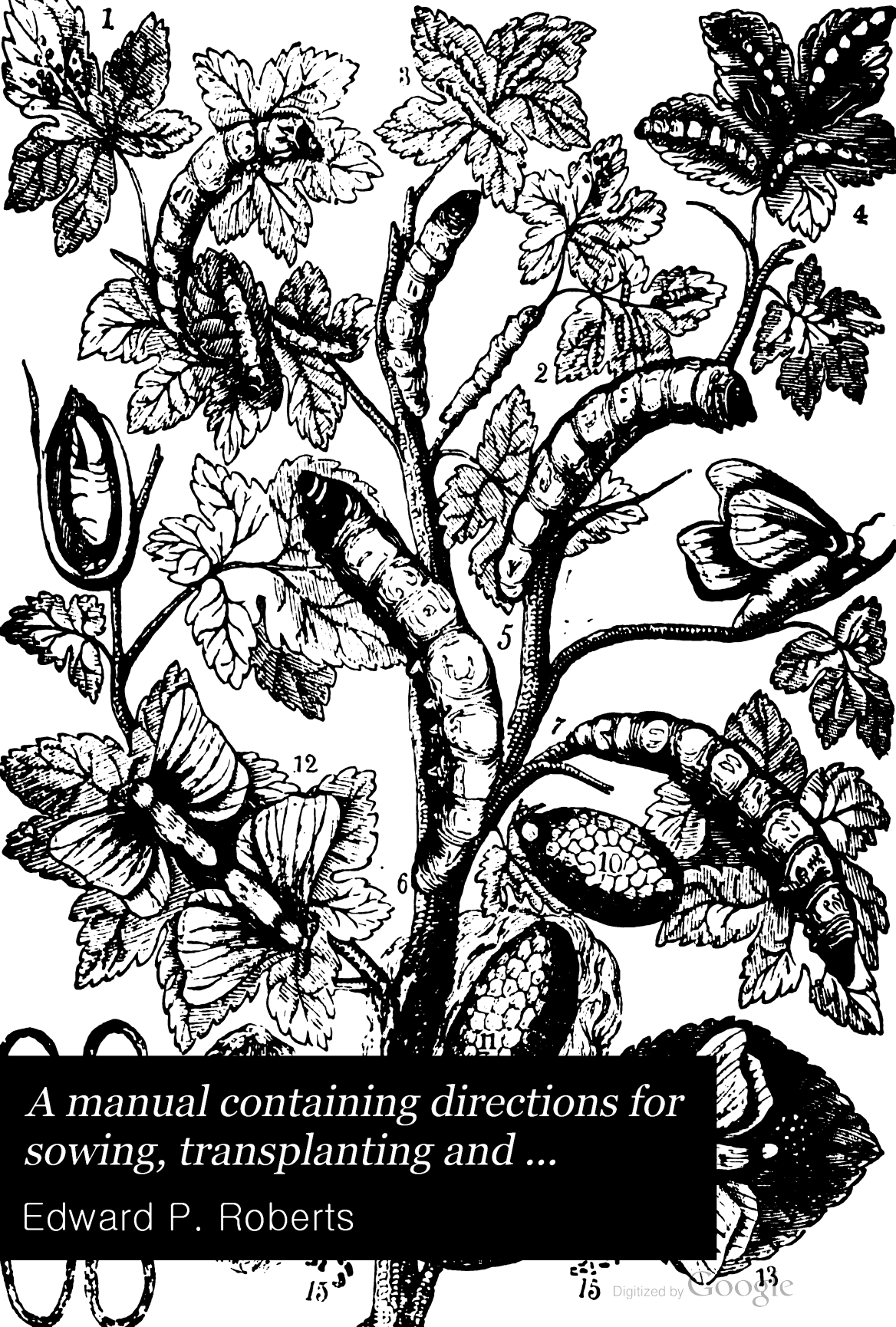


A manual containing directions for sowing, transplanting and ...

Edward P. Roberts

Published by Author -

A

MANUAL,

CONTAINING

DIRECTIONS FOR SOWING, TRANSPLANTING AND RAISING

OF THE

MULBERRY TREE;

TOGETHER WITH

PROPER INSTRUCTIONS FOR PROPAGATING THE SAME BY CUTTINGS, LAYERS, &c. &c.

AS ALSO,

INSTRUCTIONS FOR THE CULTURE OF SILK:

TO WHICH IS ADDED,

CALCULATIONS SHEWING THE PRODUCE

AND PROBABLE EXPENSE

OF CULTIVATION OF FROM ONE TO TEN ACRES,

AS TESTED BY ACTUAL RESULTS.

BY EDWARD P. ROBERTS,

EDITOR FARMER AND GARDENER.

NOT FOR OURSELVES BUT FOR OTHERS.

Baltimore:

PRINTED BY SANDS & NEILSON,

N. E. corner of Baltimore and Charles-streets.

1835.

PREFACE.

In the compilation of this *Manual*, the author has spared no time which he could snatch from his daily avocations, in reading various authors and essays on the interesting subject of the culture of silk, and he takes occasion here to say, that, for the facts, directions, and instructions, which may be found in it, he is indebted to articles in the *Encyclopedia Americana; Lardner's Cyclopædia;* the *Edinburgh Encyclopedia; Kenrick's Orchardist*, the *observations on the silk worm by William B. Buchanan*, Esq., published in 1828, the *treatise on the culture of silk*, published by *Gideon B. Smith*, Esq., in 1830; *the essays on American silk*, published in 1830, by *John D'Homergue and Peter S. Duponceau*, Esqs.; *Cobb's Silk Manual*, published in 1831; *Nicholson's Farmer's Assistant; A brief treatise of the culture of Silk*, published in Boston, in 1831; *The Trade and Navigation of Great Britain, considered, by Joshua Gee*, published in 1760; the *letter from James Mease, transmitting a treatise on the rearing of silk worms, by Mr. De Hazzi, of Munich; and the manual of the secretary of the treasury on the same subject;* both of which last works were printed by Congress, in 1828; the various articles respectively in those excellent periodical journals, *Fessenden's Silk Manual* and *Practical Farmer; The Silk Culturist;* "*The Silk Worm;*" essays in the Farmer's Register, and various other periodicals.—From all of these works, he has derived the most valuable information; but from the two compilations printed by Congress, and the treatise by *Gideon B. Smith*, Esq., he has received the most light with respect to the culture of the Mulberry, and he feels that he should not obey the dictates of his own feelings did he not particularly acknowledge the historical facts he derived from the excellent and scarce work by *Joshua Gee*, Esq., as connected with the early silk culture in America. To the treatise communicated to Congress by Dr. Mease, and the letter of the Secretary of the treasury based thereon, he owes not only the *arrangement*, but in most instances the *language* also, in which the *instructive* part of his work is dressed; nor should he pass over noticing the immense service he has derived from personal interviews with his intelligent fellow townsman, Gideon B. Smith, Esq., and he feels it due to candor to observe, that wherever he has had to reconcile the clashing of opinions, he has turned to his sensible and judicious little work, as a common mediator, and never without receiving the most able assistance. The work of Count *Dandolo* which forms the superstructure of the two congressional documents, previously noticed, is so full upon every head connected with the subject, that after reading every thing within his command, the editor's only difficulty seemed to be to separate what might be termed the purely scientific and philosophical parts, from those of a more practical character, with a view of presenting to the agricultural community, a *Manual*, wherein all might derive the necessary information to carry on the silk culture in its every branch and department, from the sowing of the Mulberry seed to the reeling of the silk. How far he has succeeded he will not pretend to say, but shall leave that to others to determine—being content, himself, in the declaration—that he labored with a singleness of intention, to promote what he considers a great and growing interest of his country.

HISTORICAL SKETCH

OF THE

CULTURE AND MANUFACTURE

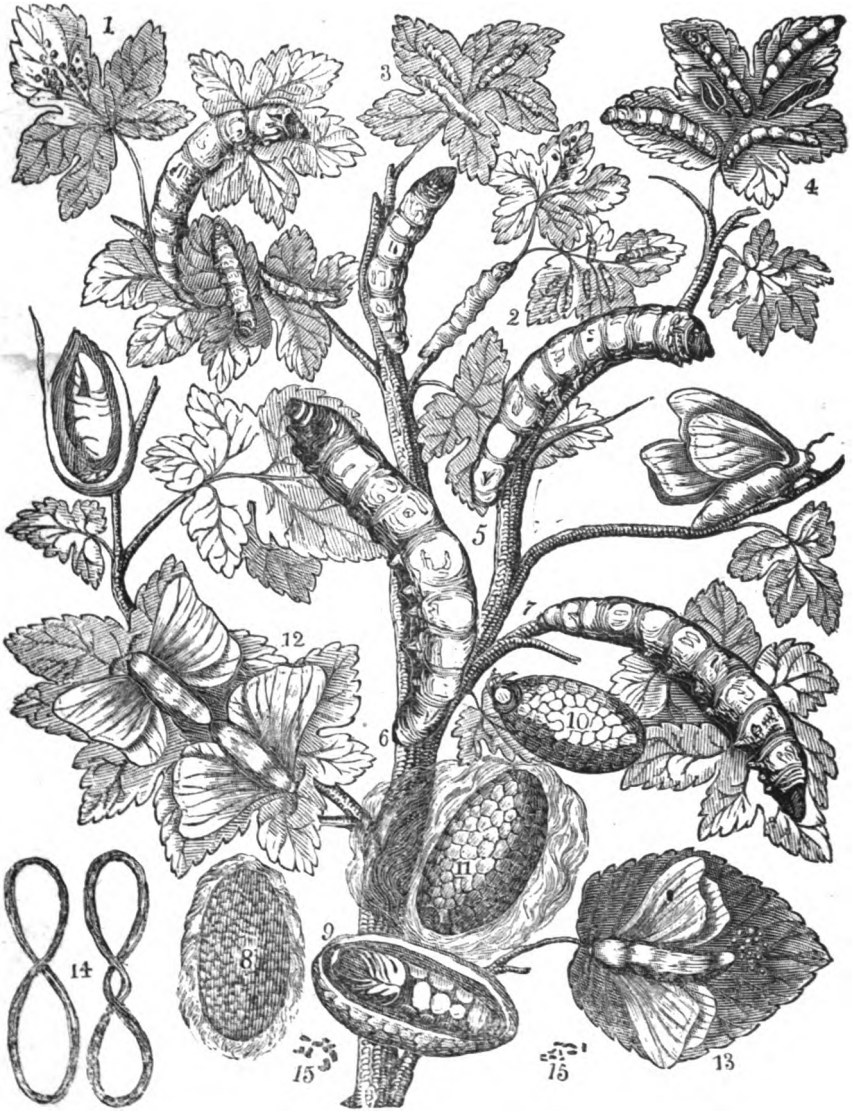
OF

SILK.

REPRESENTATION

OF THE

DIFFERENT AGES OF THE SILK WORM.



You're spinning for my lady, worm,
Silk garments for the fair;
You're spinning rainbows for a form
More beautiful than air;
When air is bright with sunbeams,
And morning mists arise
From woody vales and mountain streams,
To blue autumnal skies.

MONTGOMERY.

NON SIBI SED ALIIS.

EXPLANATION OF THE PLATE.

1. The egg, or the development and birth of the caterpillar.
2. The silk worms during the first age, till their first moulting.
3. Rearing of the worms in the second age.
4. The worms in their third age.
5. The rearing of the silk worm in the fourth age.
6. Of the rearing of the silk worms during the fifth age, until the completion of the cocoon.
7. A species of silk worm, of a dark grey colour, with singular marks.
8. The cocoons.
9. Two open cocoons, or cocoons with their grubs. The upper one contains only the shell of a developed chrysalis; but in the lower is seen the immature chrysalis, with the skin of the late moth.
10. A cocoon from which the butterfly is near emerging.
11. A cocoon from which the butterfly has already escaped.
12. Two butterflies in the act of coupling.
13. The female moths laying eggs.
14. Raw silk of a yellow or white colour.
15. Represents the excremental substance of the silk worm, in its first and last age.

HISTORICAL SKETCH,

OF THE

CULTURE AND MANUFACTURE OF SILK.

In the third number of the present volume of the *Farmer and Gardener*, the *editor* announced his intention of compiling a *Silk Manual*. Since that time he has devoted much of his leisure moments in reading such of the various authors who have written upon the subject, which were accessible to him, and gleaning from them such things as appeared to him to be necessary to be known by persons desirious of entering into the silk culture; and in the course of his readings, so many circumstances of deep interest were developed to him, that he thought it was due to the subject that the *Manual* should be preceded by a brief historical sketch of the silk worm, the origin of the silk manufacture, its introduction into Europe, and of its more recent introduction into America. But as his limits are circumscribed what he may say on the occasion, must be considered more in the light of an *abstract*, than of a historical view.

The deep and absorbing interest, which pervades every section of our country, at the present moment, and the spirit of inquiry, which is every where abroad, upon the subject of the Mulberry and silk culture, seemed to require that the public curiosity should be gratified, and its wants met in a way to direct that inquiry into profitable results. Than America, stretching as it does from the Atlantic, across an almost boundless territory, to the Rocky Mountains, there is, perhaps, no country in the world more happily adapted, by the advantages of climate and soil, to the culture of the Mulberry, which is "native born" with us, the nurturing and feeding of the worm, or for the making and manufacturing of the silk. With those natural advantages, possessed by us in so pre-eminent a degree, when the enterprise and genius of our people are considered, it becomes a matter of surprise that a business offering so many inducements of pleasure and profit, should have remained so long unimproved, and especially too, when so much pains were taken by the government of the mother country, to direct the attention of the colonists to it from the period of its earliest settlement, to just before the war of the revolution. But that surprise must cease to operate, *intensely*, when the desire inherent in our nature, of prefering *present* to *prospective* gains is considered, and also, how natural it was for our forefathers to prefer the cultivation of tobacco, a production which afforded them an *annual return*, to that of the Mulberry and silk, whose avails to *any considerable extent*, in the then state and knowledge of the business, could not be looked for, for several years. Thus situated, and desirous of realizing, at the end of each revolving year, the fruits of their labor, they adhered to the cultivation of the "*bitter weed*," and their children followed in their footsteps, until it became almost as cherished in their affections as household gods, and formed the chief staple of several of the colonies. But it has thus happened that adherence to its culture has so exhausted the soil of its fertility, that many of its owners have been driven to the necessity of departing from the haunts of their childhood, or of entering into other systems of husbandry. In this state of things, the editor desires to be an humble co-adjutor in directing public attention *once more* to the silk culture, in the hope that he may, in part, be instrumental in placing the means within the acquisition of all, of improving the soil on which they dwell, and thus relieve them from the painful alternative of going in search of strange lands. Influenced by such considerations, he was induced to undertake the present task, and with this hasty outline of his object and intentions, he will

proceed in the discharge of the duties which have thus devolved upon him. In giving the history of the silk culture, it is not his purpose to enter upon the *natural history* of the worm itself: however interesting that might be to naturalists and men of science, the honest yeomanry of the country entertain no great curiosity in the premises. To them it is a matter of perfect indifference how many antennæ and pectinated fillets the worm may possess, sufficient it is for all purposes of profit, that it is known to fabricate a beautiful thread of finely attenuated texture. He will, however, do what is infinitely better—endeavor to teach them, in a plain and unostentatious way, all things necessary to be known to enable them to lay hold of the business with a certain prospect of *large profits*. With these prefatory remarks, he will venture on that part of his plan connected with the origin, rise, and progress, of the silk business.

The silk worm, or catterpillar, is called *bombyx* from the Greek word signifying sound. There were two kinds amongst the Greeks, the one a hairy catterpillar, the other the silk worm proper, as known at the present day. The real silk web was first known, as far as history gives an account, in ancient Serica, a part of the Chinese Empire, beyond the 35th degree. Forests of Mulberry trees there grew and the worms colonising themselves among them for centuries, fed upon their rich foliage undisturbed by man, who, if he had so designed it, might have gathered the precious thread and provided himself with clothing, without much labor. The worms were permitted, however, to remain long untouched and the beautiful article of their fabrication continued for centuries alike unprofitable and neglected.

In the reign of the Emperor *Houng-Ti*, a new era commenced in the culture of Silk. The worms were then, for the first time, sheltered and carefully attended to. The history of China, as our author says, mentions, that 700 years before Abraham, and 2,700 years before the christian era, *Houng-Ti*, "the Emperor of the earth," who reigned for more than a hundred years, taught the Chinese to construct houses, carts, ships, mills and other useful things of a similar kind, and persuaded, moreover, his first and legitimate consort, *Si-Leng-Chi*, to attend to the silk worms, and to try several experiments, in order to increase their utility; wishing as he said, and as a good monarch naturally would, that his wife, the Empress, might also contribute to the welfare of his subjects. The Empress, as became her, together with the women of her household, gathered the silk worms from the trees, placed them in the imperial apartments, caused them to be supplied abundantly with leaves from the Mulberry forests, and kept clean. The result of this experiment was, that it was soon found the cocoons raised within the imperial apartments, were infinitely superior in quality, and more numerous and richer in silk than those raised in the open air, where they were exposed to the injurious effects of the changes of the temperature of the air, and where they were, also, exposed to the depredations of their natural enemies, serpents, ants and spiders.

Similar exertions for the domestic culture as we are told, were made by the succeeding Empresses, so that it became the principal occupation of the Empresses, and the apartments of the imperial palace were given up to it. From the highest rank of females, it came at last to be exercised by the whole fair sex, and ultimately gained such favor, that it turned to be the principal source of the wealth of China, and the fair sovereigns of the Empire, did not content themselves with the rearing of the worms, but attended also, to the carding and weaving of their finely spun webs. The original promotress of the art in China, the Empress *Si-Leng-Chi*, taught her women not only to convert the new material into clothing stuffs, but to embroider them with representations of flowers and animals.

In order to encourage the rearing of the worms, and the weaving and manufacturing of silk, the Emperor, the learned classes, the princes, courtiers and Mandarins, and in short, all who were sufficiently affluent dressed in satin or damask. Subsequently, silk became an article of exportation, and found its way into all the other countries of Asia, and ultimately to Europe. The caravans were seen going from the coasts of China to those of Syria, usually occupying as much as two hundred and forty-three days on the journey. The Phœnecians finally found their way to the East of Europe.

The Greeks, it is affirmed by writers, derived their first knowledge of silk from the military expeditions of Alexander into Persia and India, and *Aristotle* called the attention of his country to it as early as three hundred and fifty years before Christ.

When this fabric was first introduced among the Romans, owing to its high price, the chains only were of silk, and the filling either

of linen or cotton, and may therefore be called half silk stuffs; but a general outcry soon arose, even against the half silk stuffs, under the pretence that they were too expensive and too *womanish*. Even as late as the reign of the Emperor *Tiberius*, seventeen years after Christ, it was ordered "*that no silk dress should henceforth disgrace a Roman city*." In the reign of Marcus Aurelius, in the year 173, such attire was only worn by the ladies of the highest rank. The Syrian voluptuary, *Heliogabulus*, it is stated, was the first who wore a dress wholly composed of silk, in the year 218; but in the year of our Lord 270, *Aurelianus* denied to his wife, *Severa*, such a dress, colored with purple. "Let us not," said he, "exchange gold for spider's web,—and indeed, at that epoch, silk was of the same value with gold, being exchanged weight for weight.

The Persians enjoyed for centuries the monopoly of the trade in silk; but after their subjugation by Alexander, three hundred years before the birth of Christ, Greece and Rome became participants of the trafic; and such was the anxiety of the Romans to trade with a people who were competent to the production of so beautiful an article, that the Emperor *Marcus Antonius* sent ambassadors to China to negotiate a more direct commercial intercourse, and a second embassay was despatched with the same view in the year 272, the results of which were more favorable. The price of silk remained, however, so high, and it rose so much in the estimation of the Romans, that *Justinian* made another attempt soon after he ascended the throne to obtain a more certain as well as an increased supply. *Julian* also, subsequently made a similar effort but failed. The preachers of the doctrines of *Nestor*, who were exiled by the government of Byzantium, fled to India. Their patriarch, who resided in Persia, sent missions, and established convents and bishopricks in every direction. And it is related of two of his monks, who had been employed as missionaries in some of the christian churches which were instituted in different parts of India, having penetrated into the country of the Seres, had observed the labors of the silk worms, and become acquainted with the art of working their production into a variety of elegant fabrics. Aware of the solicitude of the Europeans on this subject, they repaired to Constantinople, and imparted to the Emperor *Justinian* the secret which had hitherto been so well preserved by the Seres, that silk was produced by a species of worms, the eggs of which might be transported with safety, and propagated in the dominions. By the promise of a great reward, says the account, they were induced to return and brought away a quantity of the silk worm's eggs in the hollow of a cane, and conveyed them safely to Constantinople about the year 555. These were hatched in the proper season by the warmth of a manure heap, the worms fed with the leaves of the Mulberry tree, and their race propagated under the direction of the monks. The insects thus happily produced from this caneful of eggs, were, it is affirmed, the progenitors of all the silk worms of Europe and the western part of Asia. Vast numbers of these insects were soon thereafter reared in different parts of Greece, and particularly in the Peloponnesus. The monks having also made themselves masters of the art of manufacturing silk, the business was conducted under the *auspicies of the Emperor, and for his exclusive benefit;* but the imperial *monopoly* could not long continue, and mankind, gradually, became possessed of the precious insects, after the death of *Justinian*, in the year 565. The people of the Peninsula, and of the cities of Athens, and Thebes, enjoyed the profit of the culture and manufacture of silk for upwards of 400 years, and the *Venetians* during the continuance of their commercial glory, distributed the products of their industry over the western parts of Europe. Things remained thus until *Roger*, the *Norman, King of Sicily*, after his return from the second crusade, in the year 1146, invaded Greece and captured a great number of silk weavers, who were carried off and settled in *Palermo*, the capital city of the conqueror.

By order of the King, the Grecian prisoners taught his Sicilian subjects to raise and feed silk worms, and to weave the various varieties of the silk stuffs, and so well did they profit by their instructions, that in twenty years, the silk manufactures of Sicily elicited the warmest commendations from most of the historians of the age.

The Saracens had before this time engaged in the manufacture of silk. Lisbon and Almeira and the island of Majorca, were famous for their silk fabrics. Louis XI of France and his son Charles VIII made attempts to introduce the manufacture, but the honor of success belongs to Henry IV.

As early as the year 1455, mention is made of a company of silk women in England, and the business had become so important in 1504, as to receive a prohibitory statute in its favor

In 1561, queen Elizabeth, or as she was more familiarly termed, the good queen Bess, received a present of a pair of black silk stockings, with which it is stated she was so well pleased that she never afterwards wore any of another material.

In 1608, James I, who had several times recommended the manufacture from the throne, addressed a long letter upon the subject, *written with his own hand*, to the Lord Lieutenants of every county in the kingdom, to whom Mulberry seeds and plants were sent for distribution, together with a book of instructions; but notwithstanding his earnest wishes on the subject, it was not until the latter part of his reign that he had the pleasure of seeing the business permanently established. Since then to the present, the manufacture of silk has been carried on extensively in England; but owing to the humidity of the climate, she never has been, and never can become, extensively or profitably engaged in the culture of the Mulberry and the management of the worms, and of necessity is compelled to seek the raw material in France and other silk raising countries. The ultimate success of the silk manufacture in England, arose chiefly from an act of religious persecution in France in 1685, when by the revocation of the edict of Nantes, all the *Protestants* were driven from France, and settled in England, where they commenced the silk business. The introduction of the silk throwing mill by Sir Thomas Lombe, of Derby, in the year 1719, greatly promoted the manufacture by the increased rapidity imparted to the process of preparing the raw material.

Having thus incidentally named Sir *Thomas Lombe*, it may not be uninteresting to mention a fact connected with the family, which will go far to shew the difficulties with which the introduction of this business was first introduced into England, and how jealous were the Italians of permitting all knowledge connected with the manufacture of silk from escaping from their country. There were three brothers, Thomas, Henry, and John Lombe, the first who was sheriff of London on the occasion of the coronation of George the II., in 1727, was knighted. About this time, the Italians had introduced great improvement in the art of throwing silk, and rendered it impossible for the Lombes, who were engaged in the silk throwing business at London, to bring their goods into the market upon any thing like terms of equality with the Italian. The younger brother was a lad at the time, and by the laws of the Italians it was made *death* for any one to discover any thing connected with the silk manufacture: with this addition, the forfeiture of their goods, and their person and name to be painted on the outside of the prison walls, hanging to the gallows by one foot, with an inscription to remain as a perpetual mark of infamy. These severe and degrading penalties would, one would think, have been a barrier to the curiosity of almost any one; but it had no dreads for young Lombe. He proceeded to Italy, and after various ineffectual attempts to procure drawings and an insight into the business, he at last ingratiated himself into the good opinion of a priest, who confessed the family to whom the silk factory belonged; through his interest he obtained employment in the mill as a fillatoe-boy to superintend a spinning engine. Whilst others slept he was awake and diligently employed in his arduous and dangerous undertaking. He had possessed himself of a dark lantern, tinder box, wax-candles and a case of mathematical instruments. In the day time, these were secreted in the hole under the stairs where he used to sleep, and no person ever indicated the least curiosity to ascertain the extent of the possessions of young Lombe, who had so far disguised himself as to present the appearance of a most wretched being. By this means he obtained drawings of every part of the machinery, and through means of his friend the priest, he conveyed them to England in piece meal, in bales of silk. These originals are still preserved in the Derby mills. After *Lombe* had completed his drawings he waited until an English ship was on the point of sailing for England, when he left the works and hastened on board. His absence excited suspicion, and an Italian *brig* was despatched in pursuit; but the English vessel, being the better sailer of the two, escaped.

There are other mills more recently erected at Derby on similar principles, which greatly surpass those of the Messrs. Lombe, in grandeur and efficiency, but the old mill continues to be regarded as the chief object of interest, being the first established of the kind, and associated with so romantic an incident in the life of one of its first proprietors.

This brings us to that part of the history of the culture which relates more immediately to our own country.

The culture of silk in America first commenced in the state of *Virginia*, the attention of the settlers being called to it by the British

government, in the 20th year of the reign of James I. Having unsuccessfully attempted to introduce it into his own kingdom, in Europe, he was the more desirous of doing so in his transatlantic possessions, in order that his manufacturers at home might draw their supplies of the raw material from his colonies in America. With the view of furthering his object, which had now become quite a favorite with him, silk worm eggs, Mulberry trees, and printed directions were early sent to Virginia, to encourage the silk culture, and as the king had "understood that the soil naturally yieldeth stores of excellent Mulberries," he gave special instructions to the Earl of Southampton, to urge the cultivation of silk in the colonies in preference to tobacco, "which brings with it many disorders and inconveniences." In accordance to which, the Earl wrote a letter on the subject to the governor, and council of Virginia, in which he desired them to compel the colonists to plant Mulberry trees. In 1623, the colonial assembly directed that they should be planted; and in 1656, the culture of silk is described as the most profitable commodity for the country, and a penalty of three pounds of tobacco is imposed upon every planter who should fail to plant at least ten Mulberry trees for every hundred acres of land in his possession. A premium also of 4000 pounds of tobacco was at the same time given to a person as an inducement to remain in the country, and prosecute the trade in silk; and the following year, a premium was offered of 10,000 pounds of tobacco to any one who should export £200 worth of the raw material of silk, and 5000 pounds of the same article to any one who should produce 1000 pounds of wound silk in one year. The act coercing the planting of a given number of trees was repealed in 1656, and renewed two years thereafter; but the system of bounties and penalties was continued until 1666, when, owing to the success of the culture they were deemed unnecessary; but in 1619 it was again renewed; and subsequently entirely ceased.

While Sir William Berkeley was in England, on the occasion of his reappointment as governor, in conversation with the King, his majesty strongly recommended the culture of silk, and as an inducement to the colonists to attend to his advice, mentioned "that he had formerly worn some of the silk of Virginia, which he found not inferior to that raised in other countries."

The encouragement given by the colonial Legislature, had the desired effect, a spirit of generous enterprise and emulation was infused into the minds of the agriculturists of the old dominion, Mulberry trees were generally planted and the raising of silk worms was made a part of the business of many of the farmers. Indeed, so zealously did the larger planters and farmers enter into it, that many were found to come forward and claim the premium offered by the Legislature; and among these was a Major Walker, a member of that body, who produced satisfactory testimony of having 70,000 trees growing in the year 1664. The eastern part of the state abounds with the White Mulberry trees at present, thus offering the inhabitants the means of promptly taking up the silk culture, as a part of their system of husdandry.

In that excellent and scarce work, entitled "*The trade and navigation of Great Britain and Ireland*, by Joshua Gee," published in 1760, there are numerous evidences of the deep and pervading interest which was then, and had been long felt by the government of England, to introduce the culture of silk into their colonies. One of these relates to the interest taken by James I., and as it is a little different, rather in form, however, than substance, to the version already given, we will transcribe it.

"King James the first concerned himself much in trade; yet in imitation of Henry IV. of France, (who was wonderful assidious in promoting all sorts of manufactures, and among the rest, that of planting Mulberry trees, and raising silk,) made some essays towards such a design here, and he and his courtiers seemed to be very fond of the undertaking, and letters were writ to Virginia to promote that manufacture. Some small progress was made there and letters passed between the planters and gentlemen here; but as soon as they thought they had engaged the planters to begin upon it, instead of promoting it heartily, and sending some able and skilful persons to direct the undertaking, they threw all upon the planters, and that noble design came to nothing, whereas that of France succeeded to the immense profit of that kingdom." p 3. 6th ed.

If any proof were wanting of the adaptation of our country, in climate and soil for the silk culture, it is to be found in the pages of this work, the edition of which now before us is 75 years old. In *page* 20, in *a chapter* on "Trade between England and Carolina," Mr. Gee remarks:—

"Carolina lies in as happy a climate as any in the world, from 32 to 36 degrees of northern latitude, the soil is generally fertile; the rice it produces is said to be the best in the world; *and no country affords better silk than has been brought from thence.*"

Again, in p. 22, he remarks:

"As Carolina is likely to become the property of the crown, the rich grounds that lie under the Apulachean hills, and through Virginia, etc. are inviting places for raising silk."

And in p. 104, &c. we have the following strong proof of the great interest felt by the government of Great Britain, not only for the culture of silk in this country; but of the then existing favorable opinion as to the practicability of it. Mr. *Gee* says:

"If care was taken to cultivate and improve the raising of silk in our plantations, *Carolina*, *Virginia*, *Maryland*, and *Pennsylvania*, would produce the best of silk, and as fit for organzine as any in the world; for these countries produce vast numbers of white and other Mulberry trees, which grow wild and spring up almost every where in great abundance, which looks as if nature had called us thither to propagate that manufacture; and if put on foot, would in time be of as great advantage to this nation as any employment in the plantations; for as I have already observed, the manufacture of silk is a most profitable undertaking, where the land and air is proper for raising it."

"The vast riches of China, by this manufacture is sufficient to demonstrate the great advantages thereof; and the extraordinary treasure the Duke of Savoy draws into his country by silk, which is made in that little principality of Piedmont, as I have already observed, is also another instance; we may judge, if he draws above two hundred thousand pounds a year from England, what his profits are which he draws from Holland, and other places where the manufacture is carried on to a very great degree."

* * * * * * *

"Very great things may be expected by our encouraging and promoting the manufacture of silk in our colonies. * * * * No part of the world better [suited to the silk worm] than is our colonies; no silk *cleaner*, more glossy, of a better body, nor fitter to answer the use of the fine thrown silk we have from Italy, than the small quantity of silk that has been imported from thence." [The American colonies.] * * * * * * * *

"We are told by a gentleman of good intelligence, the whole charge of making a a pound of silk in China, does not stand in above five shillings, and almost any person, man, woman, or child, may work at it, and a man or woman, with a child to assist in directing the thread of the silk, may with a proper machine *reel from the cocoon or silk bag, one pound in a day.*"

* * * * "Now I should think the labor of slaves employed in this work, would produce above twice as much as those that are employed in planting either sugar or tobacco."

These are the opinions of an eminent English political economist, who wrote three quarters of a century ago, and they go to establish two points very clearly, that the silk culture was esteemed, even at that early day, very highly by the most judicious thinking men, and that the peculiar advantages possessed by our country for the culture, was then well understood, and duly appreciated by the first intelligences of the age.

As early as 1732, upon the settlement of Georgia, the culture of silk was also contemplated as a principal object of attention, and lands were granted to settlers upon the express condition, that they planted one hundred White Mulberry trees on every ten acres when cleared. Trees, seed, and the eggs of the silk worms, were sent over by the colonial trustees, and an Episcopal clergyman, and a native of Piedmont, were engaged to instruct the people in the art of rearing the worms and winding the silk. And in order to preserve the spirit of the silk culture, and to keep the views of government present before the people, the public seal had on one side of it a representation of silk worms in their various stages, with this appropriate motto, "*non sibi sed aliis*"—NOT FOR OURSELVES BUT FOR OTHERS. By the manuscript proceedings of those colonial trustees, it appears that the first silk received from Georgia, was in the year 1735, when 8lbs. of raw silk were exported from Savannah to England, where it was made into a piece and presented to the Queen. The exportations from Georgia increased until the year 1756. During the intervening periods large quantities of silk were at times exported to England. The exportation of raw silk in 1759 amounted to upwards of 10,000 pounds, and brought two or three shillings per pound more than that of any other country. It is stated that the last parcel brought for sale to Savannah was in the year 1790.

Attention to the Mulberry and silk culture

appears to have been paid at a very early period in South Carolina by the ladies, with whom it was a fashionable occupation, and who were in the habit of sending their raw silk to England. As far back as 1755, Mrs. Pinckney, a lady distinguished alike by her patriotism, and excellently improved mind, took with her to England a quantity of superior silk, sufficient to make three complete dresses. One of these was presented to the Princess dowager of Wales, another to Lord Chesterfield, and the third being retained by her, was a few years since in possession of one of her daughters in Charleston. Even at this early period, these American productions were allowed by competent judges to be equal to any ever imported into England. The dress in possession of the daughter of Mrs. Pinckney, Mrs. Horry, in Charleston, South Carolina, was in 1809, still in a good state of preservation, and remarkable for its beauty, firmness and strength. Though the quantity of raw silk exported from this country was always small, yet its quality according to the certificate of Sir *Thomas Lombe*, the eminent silk manufacturer, was excellent, having as much strength and beauty as the silk of Italy.

In Georgia, at New Bordeaux, a French settlement about 70 miles above Augusta, the people supplied much of the high country with sewing silk during the war of the revolution.

In the year 1770, we see it stated by the editor of the Genesee Farmer, that a filature was established in Philadelphia, and premiums announced, and that in the following year, 1771, about 2,300 lbs. of silk were brought there to reel. The *ladies* in particular gave great attention to the subject. As early as 1770, Mrs. *Susanna Wright*, at Columbia, Lancaster county, made a piece of *mantua*, 60 yards in length from her own cocoons; and that, to give eclat to these colonial designs, the Queen of Great Britain gave her patronage by appearing in a court dress made from American silk. *Grace Fisher*, a minister among friends, made considerable silk stuff: a piece of which was presented by governor *Dickinson* to the celebrated *Catharine Macaulay*. It is also stated that many ladies before the revolution wore silk dresses of their own fabrication.

In the year 1771, the culture of the silk worm commenced with considerable spirit in the states of Pennsylvania and New Jersey, and a society was formed for that purpose. The worms were fed upon the *native Mulberry* until the White Mulberry could be reared, and it is remarked that they *thrived well and yielded good silk*. While this association was in existence, many garments were made of silk reared by its members; but the war of the revolution put a stop chiefly to their patriotic labors, and suspended, in a great measure, the culture of silk. Some few of the more persevering of the members of the society, still continued the culture on a small scale, producing from year to year a sufficiency of sewing silk for domestic use. In 1790 Nathaniel Aspinwall, of Connecticut, made a patriotic effort to revive the Mulberry culture in New York, Pennsylvania and New Jersey, and planted, and caused to be planted, thousands of trees in those states, for which good service, his memory deserves to be embalmed in the grateful recollections of his countrymen. Among those gentlemen who took an active part in starting the culture in Pennsylvania and New Jersey, in 1771, Doctor Franklin and Dr. Cadwallader Evans stood conspicuous, as they did in all other good works within the range of their influence.

During the last few years a spirit has been revived in the state of Pennsylvania to engage in the silk culture, and particularly in the neighborhood of Philadelphia, where several large establishments are projected and being projected. One of the great obstructions in the advance of the silk culture in this country, from the earliest attempts to establish it, has been the want of a market for the sale of the raw silk, either in cocoons, or when reeled; and another is, the idea which prevails of the immense difficulty of reeling it to advantage; but both of these have ceased to operate; markets in the eastern cities, offering fair remunerating prices, are already established for any quantity of raw silk in any state in which it may be offered, and the simplicity of the newly invented reel of Mr. Gay has brought the art down to the level of almost any capacity. For ourself we have ever looked upon the difficulty of reeling as being much more *imaginary* than *real*, and the success of the lady of whom we spoke a few weeks back, who, with an old thread reel, managed to disengage the web from the cocoons and to make as excellent sewing silk as we ever beheld, shews that we were correct. We have been taught, from our youth up, that no difficulties are insurmountable when opposed by willing hearts and industrious hands, and we

have scarcely ever seen an instance in which the truth of the position was not fully established.

At Economy, Pennsylvania, near Pittsburgh, the culture in all its branches, from the feeding of the worm to the manufacture of the silk is extensively carried on by those worthy gentlemen and public spirited men, the Messrs. Rapp, and we have seen specimens of the silk wove there, which were no less beautiful to the eye than elastic in quality.

Mr. Joseph Ripka of Philadelphia has a flourishing plantation containing *ten* acres of Mulberry trees on the Point-no-Point road, and intends entering into the silk culture on a large scale; and a Mr. *Upton*, also of Philadelphia, has been engaged in the silk manufacture, but to what extent we are unable to say.

In Maryland the culture of the Mulberry and silk worm has for many years been conducted on a small scale by individuals. We have seen many specimens of fine sewing silk, and have been informed that several ladies in the lower part of this state on the Western Shore, as well as others on the Eastern, have succeeded in fabricating very pretty specimens of silk cloth. Among those in our own city who have taken a lead in this business, we should not omit to mention the names of Mrs. Kesiah Norris, Mrs. Flax, Mr. Wm. B. Buchanan, Mr. Gideon B. Smith and Mr. J. Y. Tompkins. The three latter individuals have largely contributed by their intelligent and praiseworthy labors, not only to keep alive the spirit of enterprise, but have thrown much light upon the subject. Mrs. Norris too, deserves especial notice, being of late years, perhaps the first one to engage in it in this quarter; and had she not been cut off in the midst of her usefulness, we have no doubt she would long ere this have brought the manufacture to perfection. Some years before her death she and her husband had settled upon a small estate near Baltimore, and commenced a plantation of the Mulberry, with the view of carrying on the business, and just as those trees were beginning to yield food for her worms, she was stricken to the earth. It does not appear that any one else in Maryland, so far as our researches have gone, ever undertook it as a branch of husbandry, and this is the more to be wondered at, as no state in the Union is more happily situated for conducting it to advantage. Her climate and soil are both peculiarly adapted to the culture of the Mulberry; she has a great proportion of light, sandy, gravelly and dry lands, which years of exhausting culture have rendered almost useless for other agricultural purposes, that could be profitably occupied in this culture. These circumstances would seem to point out with unerring certainty the policy of entering into the silk culture, not only to Maryland, but to every other state in the Union similarly situated, and without intending or wishing to be understood as being invidious, we might mention as kindred states, New Jersey, Delaware, Maryland, Virginia, North Carolina and South Carolina, as well as parts of Georgia.

In *Connecticut*, attention to the culture of silk commenced about the year 1760, by the introduction of the White Mulberry tree and eggs of the silk worms, into the county of Windham and town of Mansfield, from Long Island, New York, by that patriotic citizen and enterprising agriculturist to whom we have before alluded, Mr. N. Aspinwall, who had there planted a large nursery. He also planted an extensive nursery of the trees in New Haven, and was active in obtaining of the Legislature of the state of Connecticut, an act granting a bounty for planting of the trees. The premium was liberal, being *ten shillings* for every hundred trees which should be planted, and preserved in thrifty condition for three years, and three pence per ounce for all raw silk which the owners of trees should produce from cocoons of their own raising within the state. After the necessity of a bounty upon trees had ceased, one was granted on raw silk manufactured within the state. An old statute continues in force, which requires skeins of sewing silk to consist of twenty threads each two yards long.

It may not be amiss here to mention as an act of justice, that in England the most intense anxiety existed to further the culture of silk in this country, nor was this praiseworthy solicitation confined to the King or his ministers; individual associations fully participated. The patriotic society in London for the promotion of arts, &c. paid several hundred pounds sterling between the years 1755 and 1772, for premiums for planting Mulberry trees, and for cocoons and raw silk made, to various persons in Georgia, South Carolina and Connecticut.

After the war of the revolution, the business of the silk culture was renewed and gradually extended; and it is recorded that in the year 1789, 200 lbs. of raw silk were made in the town of Mansfield, in Windham county, Connecticut. In 1810, the value of the sewing

silk, made in the three counties of *New London*, *Windham*, and *Tolland*, was estimated by the U. S. Marshal, at $28,503, but the value of the domestic fabrics made from the refuse silk, and worn in these counties is not taken into the account; and it is affirmed that they may be fairly estimated at half of that sum. In 1825, it is stated that the silk culture had increased so much in Windham county as to be double what it was in 1810. In the letter of the Hon. *Ambrose Spencer* of Albany, of New York, to S. M. Hopkins, Esquire, of Geneva, of the same state, dated the 7th April, 1835, he introduced the following as facts, on the authority of the Burlington Free Press: that raw silk was produced in the town of Mansfield, Connecticut, to the amount of over $60,000 in 1834; and that the county of Windham produces *five tons* of silk annually, valued at $500,000, and that if reeled would be worth double that sum. This statement the judge fully believes is substantially true. Whether the other counties engaged in its culture in Connecticut have been blessed with an equal ratio of increase, we have no present means of ascertaining; but from the general reputation for sagacity and thrift of the people, we rest assured that there has been no standing still in the prosecution of a business offering so many inducements of pleasure, interest and *profit*. In 1828, the Hon. *Zalmon Storrs* stated in answer to a circular addressed to him by the Secretary of the treasury, "that three-fourths of the families in the town of Mansfield were engaged in raising silk, and make annually from 5 to 10, 20, and 50 lbs. in a family, and one or two have made each 100 lbs. in a season; it is believed that there are annually made in Mansfield and the vicinity from three to four tons. The farmers there, considered, at the period of which we are speaking, the amount received for their sewing silk as so much clear gain, as the business did not interfere with the regular farm work of the men, or the domestic duties of the females, upon whom with the aged and youthful members of the family, the care of the worms, and the making of the sewing silk chiefly devolves."

A new factory has just been erected at Hartford, called the Connecticut silk factory, with a capital of upwards of 40,000 dollars; the building is 120 feet long by 44 feet wide, two stories high, with a basement story. This factory has about 100 silk looms with machinery, the whole to be operated by a steam engine of 8 or 10 horse power. For want of raw silk, the company has been compelled to go into the manufacture of Tuscan straw, gimps, fringes, &c. articles in which but little raw silk is incorporated. A circumstance which shows that the *demand* is very far in advance of the *supply*: and another is going into operation at Concord; the latter establishment has commenced the cultivation of the Mulberry.

Mr. Harvey Johnson, in a letter to the editor of the Silkworm, states, that his father as far back as 50 years ago planted "2000 trees and carried on the silk business in Connecticut for a number of years, that though it was difficult to find workmem who understood dyeing, weaving or manufacturing, they made a number of pieces of cloth for women and men's wear, one piece of handkerchiefs, and a number of pairs of stockings, some knit and some wove, and some pairs of gloves, and he has still a pair of gloves which he believes were made 35 years ago."

Societies having for their object the introduction and extension throughout the respective *counties*, of the knowledge and practice of raising Mulberry trees, of feeding and managing silk worms, and reeling silk from the cocoons in the most approved methods, have been formed in the counties of Hartford, New Haven, Middlesex and Fairfield. In Norwich a company has been formed, who have planted 1,000 trees, and fed the last season 120,000 worms.

The Legislature with a most laudable desire to promote the interests of the state, have passed a law giving a bounty of one dollar for every hundred Mulberry trees properly planted and cultivated until they are five years old, and also fifty cents for every pound of silk reeled in the present improved mode; and still further to extend its fostering care to this peculiar branch of industry, in chartering the *Exchange Bank*, they rendered it obligatory upon that institution to furnish every county in the state, applying therefor, with 8 lbs. of Mulberry seed, and also with eggs of the silk worm not exceeding 100,000; one reel for the purpose of reeling the silk, as also a person capable of teaching the art and mystery of raising the Mulberry, and reeling the silk, which service is to be continued for five years.

The editor of the Silk Culturist says that he has in his possession several samples of beautiful changable silk made in Berlin, Connecticut, in 1791, by Mrs. Elisha'ma Brandegee, taken from dresses now in the family of Mr.

Brandegee, one of her sons, who says he helped to pick the leaves to feed the worms, and that the silk was reeled by his mother and wove in that town. The fabric is even and the surface is smooth and lustrous, the colors bright and fast. The sample of one dress is wove of red and black, and was intended for a present to the lady of General *Washington*, but for some cause not remembered was never presented to her.

In all the other New England states, with the exception of Maine, perhaps, more or less attention has been given to the silk culture. In *Massachusetts* great attention has been paid to it within the last few years, and the art of manufacturing the article has, perhaps, been brought to greater perfection there than in any other part of our country. Mr. Cobb, of Dedham, in the vicinity of Boston, began the cultivation of the Mulberry tree in 1826, and since that time, notwithstanding the nature of the soil, which is not the most favorable, has, extended his operations so much as to be able to bring his manufactured silk to the Boston market to the amount of about one hundred dollars per week." Mr. Cobb's factory has lately been merged in a new company, with a capital of $100,000, called the New England Silk Company, whose sole object is the manufacture of silk under the superintendence of Mr. Cobb. Another company has been formed with a capital of $200,000, and have already commenced the erection of a factory for the manufacture of silk at Northampton, and it is their intention to supply themselves with food for the worms from a plantation of their own Mulberry trees. In the county of Essex, it is stated that some years since, in consequence of the recommendation of the agricultural society, several farmers planted the Mulberry tree very extensively, and that there are at this time growing there, in full vigor, upwards of 100,000 trees, which would yield silk amply sufficient to supply that county with silk, besides being a supply for exportation.

Capt. A. Holcomb, of Sterling, Mass., has a fine orchard of Mulberry trees now 10 years old, upon which he fed his silk worms the present season.

The Legislature of Massachusetts, in a just spirit of enlightened patriotism, has passed a law granting a bounty of 50 cents for every pound of silk reeled or thrown from cocoons raised in that state. This act is to continue in force for two years, and will doubtless tend to stimulate the farmers of that state to enter into the culture of silk with all becoming zeal, as this bounty will at least cover the expense of reeling, and thus enhance the profit to the grower. Having alluded to the profit of the culture in the state of Massachusetts, we shall mention a fact which we find in the *Silk Worm*, a most excellent and well conducted monthly publication, edited by *S. Blydenburgh*, of Albany, New York. It is there given as being comprised in the "Instructions" upon the silk culture, issued by the Hamilton county agricultural society of Ohio, last year.

"Four acres of ground planted in Mulberry trees, near Boston, afforded enough food, in one season, for the support of as many silk worms as produced *four hundred and twenty* pounds of silk, worth three dollars and fifty cents per pound, amounting to $1,470. All the labor was performed by *four girls*, whose attention was required but a small portion of the year." This fact contains one of the most powerful arguments in favor of the culture which we have yet seen. We find four girls—farmers' daughters, or *helps*, as hired persons are called to the eastward,—successfully attending to four acres of Mulberry trees, gathering the leaves, feeding the worms and performing all the labor incident to the business, and what is the result? Why at the depressed price of $3 50 per pound they made silk enough to bring $1,400, or $350 to each hand: now if the present price which prevails in Massachusetts, $4 per pound from the purchaser, and fifty cents from the state, had then prevailed, each of those females would have averaged $472 25, or the whole have made, in the aggregate, $1,890, and independent of the state bounty, the 120 lbs. of silk would have brought $1,680, or $420 to each of the females engaged in the feeding of the worms. And as on an average 3,000 worms, completing their cocoons, will make a pound of silk, there were but 1,260,000 worms fed on these four acres, whereas that quantity of land is competent to produce leaves enough to support 2,160,000 worms; thus it is evident, that the produce here recorded is far from being a large one, for had the orchard been planted to the extent of the capacity of the ground, 720 lbs. of silk might just as readily have been raised as the 420 lbs.

In this state, several laboratories, or as the silk worm houses are familiarly called, *cocooneries*, have been established, and more are contemplated. Amongst the most important

of these, we would mention those of Mr. Whitmarsh, Dr. Seeger and Dr. Stebbins. That of the first named gentleman is calculated to accommodate nearly *five millions of worms*, but at present his number does not exceed eight hundred thousand. The capacity of Dr. Seeger's is but for 16,000, and that of Dr. Stebbins for 20,000: but the companies to which we have before reverted will have still more extensive ones, as their means of supporting worms may be developed. The number of *large establishments*, is, however, no criterion to judge of the magnitude of the silk business in this state; for almost every farm-house is or soon will be, a greater or lesser *laboratory*, each farmer making the silk culture a branch of his system of husbandry, which is mainly attended to by the women and children, who are thus made the most productive portions of each establishment.

In the state of New York no large results have as yet taken place, though for several years an active spirit of inquiry has been very laudably kept alive by the enterprising agriculturists; and during the late war the culture was carried on to some extent by Mr. *Samuel Chidsey*, Cayuga county, who manufactured during that period sewing silk to the amount of $600 per annum; and this gentleman also introduced the culture of the Mulberry into the town of Scipio, on its first settlement. The success which have attended the exertions of their neighbors, has, however, awakened a feeling of emulation, and associations have already been formed, and are forming, for the purpose of extensively carrying on the business. A company is already in operation at Poughkeepsie, at the head of which is the Hon. Mr. Tallmadge, U. S. Senator, and a society has been established in the city of New York with similar objects. The silk business has been recommended to be introduced into the Penitentiary, so that the state will soon become interested in its success, and although we doubt the propriety of bringing the labor of convicts into competition with that of the honest husbandmen of the country, in so beautiful and delicate a business, we have no doubt that good may grow out of what we view in the light of a wretchedly *short-sighted expedient*.

In Rhode Island, the business is becoming popular, and a company is already in existence at Providence, who have a plantation of 30,000 trees, from four to five years old, from six to eight feet high. Of the productiveness of the trees of this plantation, we have seen some very *sanguine* calculations, such as that *each* tree, for the next five years would average half a pound of silk, making in the aggregate 15,000 lbs. of silk: this, in our belief is greatly beyond what those trees would produce even at 20 years old, and at present by at least in the proportion of 2½ to 1. The highest estimate of the quantity of foliage produced by trees of the age of the above, is 30 lbs. which would only support 600 worms during the feeding season, and as it takes 3,000 cocoons to make a pound of silk, it would take 2½ of these trees to make a ½ pound, so that 6,000 pounds is much nearer the amount of their probable yield than 15,000, as assumed in the statement whence we take this.

In Vermont and New Hampshire many farmers' wives and daughters have fed worms for several years as matter of curiosity more than of profit; but within the last few years they are beginning to turn their attention to it as a lucrative business, having the past spring been engaged in arranging their orchards, and although less favourably circumstanced as to climate than the other New England states, there is no question that the enterprise of the people of these states, will, at least, succeed in making it a profitable branch of their system of agriculture.

In *Maine*, as far as we can learn, little or nothing has been done; but it is not to be presumed that a hardy, industrious and intelligent population like that of Maine, will sit with folded arms and see the palm of victory borne in triumph by their neighbors, without at least placing themselves in a position to contend for the rich prize.

In Kentucky and Ohio, many individuals have been for some years engaged in hatching small numbers of eggs, and feeding the worms. In the latter state a very efficient society has been formed with a view of collecting and disseminating information. In *Indiana*, where the Agricultural Societies are invested with *chartered rights*, and where from the very nature of the enactments which give them being, they must exercise a healthful influence, the business of the Mulberry and silk culture is especially taken up by the *General State Board, as a matter of primary concern*, and we have no doubt the happiest effects will spring from their praiseworthy exertions. In *Illinois*, while inhabited by the French, silk is said to have been raised by that notable people; but to what extent we have no present means of ascertaining; nor

are we able to trace the period when the culture was arrested. Many of the trees, however, we are told, remain, and it would be an easy matter to multiply these, and commence anew this profitable branch of business. No one who knows the enterprising character of the people of the west can presume, that they will leave so good a chance of emolument unimproved, when they have so many facilities within their possession for entering into the culture under most favorable auspices.

We have thus briefly sketched the principal facts as they have been placed within our reach, and without pretending to have given any thing like a full view, we merely claim for what we have written, the desire of *fidelity*, which has never been absent from our mind for a solitary instant.

In closing this branch of our labors, we must be indulged in a few remarks expressive of our hopes, that a feeling and an interest has already been aroused, which will not slumber until the triumph shall be complete. We are doubly solicitous on this head, because we see in the success of the silk culture, the surest means that philanthropy could desire, for sustaining the thousands and tens of thousands of poor women and children, whose support is now stinted and precarious; because we see in it too, a radical cure for an evil which is sweeping the inhabitants from the old settlements with a force which almost threatens depopulation to many neighborhoods; and lastly, because, it will afford the pecuniary ability of improving the other portions of each estate on which its culture may be introduced. To several of the old states, it offers the only available resource for political safety,—the only guaranty against those encroachments which never fail to follow in that train of evils that befal the *weak* in the vicinity of the *powerful*. There is no truth more firmly enforced by history, than that *peace* and *independence*, is only to be expected where the ability to repel and punish aggression is enjoyed. It should, therefore, be the policy of small powers living in close vicinage with large ones, to keep a careful prospective eye about them, in order that their more potent neighbors may not be provoked by their weakness to contemplate their subjugation; for the history of the ancient Republics confirms the melancholy truth, that *power*, in the view of nations, is but another word for *right*; that the ties of consanguinity and the claims of common origin, offer no barriers to that unchastened ambition and unbounded desire of conquest, which is indulged in by most states, towards their weaker neighbors.

MULBERRY CULTURE.

At the beginning of the culture of silk in Europe, the *Black Mulberry, Morus Nigra*, was principally used; but upon mature experience it was found that the *Morus Alba*, the white *Italian Mulberry*, was better adapted to the culture. This however must be considered relatively only, and as alluding exclusively to a comparison between these two particular varieties, and it must be considered too, as having relation to a period long before the *Morus Multicaulis*, the *broad silky leaved, new variety*, of the *Chinese or many stalked Mulberry*, was introduced either into Europe or America, that being only within the last ten or twelve years known in either country. It may, therefore, perhaps, be proper to express our opinion of it, and this we shall do with perfect integrity of purpose. Like most of the exotic trees of China origin, which have been introduced into America within the last few years, sufficient time has not yet elapsed to test whether it will become acclimated or not. The last severe winter, however, would go very far to settle the question, if the fate of all the trees planted in our country were known, for it may be fairly affirmed, that no winter, within the recollection of living witnesses, has ever been more intensely cold than it was; nor were there ever one better calculated to test the ability of foreign trees to withstand frosts. What effect it had upon the *Morus Multicaulis*, then, becomes a matter of deep moment, of profound and absorbing interest. It it known that the whole tribe of Mulberries are tenacious of life, and will, where but the least chance is given them, support vitality; sometimes, indeed, in despite of the harshest and most neglectful treatment, they willlive on to shew to those by whom they have been thus rudely treated, how unconquerable are their powers of preserving existence. And so far as our experience goes, and as we have been able to derive any information upon the subject, the *Morus Multicaulis* does not form an exception to the general rule. In most of the eastern states, where this beautiful tree has been introduced, it suffered greatly from the frosts of last winter; generally being killed down to the ground. Dr. *Stebbins*, the intelligent Secretary of *Hampshire County Agricultural Society, of Massachusetts*, in the account of his inspection of several establishments where it was grown, states, "that he had examined a standard tree of the *Morus Multicaulis*, which was set in an exposed situation, and has withstood the severity of the three last winters, as uninjured as an *elm* or *oak*, or any of the most hardy forest trees. It has attained about its greatest height, 8 feet, and is in full life to the extremity of the topmost shoot. The grass that has grown about the roots, therefore, has not been much disturbed by hoeing, and in consequence acquired *hard wood*, the very result wanted by the cultivator of the Chinese Mulberry. In the New England Farmer, Vol. XII, page 393, in an article by Mr. William Kenrick, it is observed:—"this Mulberry braves the most rigorous winters of France, not having suffered in the least even during the severe winter of 1829—30. I have taken particular pains to ascertain how they have fared in the extreme north of that country, and have very lately been informed by letter from M. *Eyries*, a gentleman from Havre, that they have supported well, during *ten* years the most rigorous winters of the north of France." Again he says:—

"Very late in the spring of 1833, more than a hundred young trees of the Morus Multicaulis were set out on the place of *S. V. Wilder*, Esq. in Boston, Worcester county, Mass. The soil springy, the exposition cold and sloping to the north; Mr. Joseph Breck, a distinguished botanist, having especial charge of these plants, has lately very critically examined them. Thus unfavorably situated and unprotected, they have borne the *last winter*, 1833---34, without injury, except only the top of the twigs. Mr. Breck is persuaded that they are even hardier than the common White Mulberry, since some hundred of the latter which stood very near were killed half way down to the ground by the same winter.

Another correspondent of the same Journal, who writes under the signature of R. advances the opinion, and "cites facts to maintain his belief, that the Chinese Mulberry is more hardy than many of our orchard, or even forest trees, but *may be killed when young, if planted in a rich moist soil.*"

In *North Carolina*, we learn from an esteemed friend and valuable correspondent, Mr. *Sidney Weller*, that his trees "endured the severe frosts very well. The only injury is, that the

top ends of some branches have been killed." In the lower part of Virginia, where some of the *Morus Multicaulis* have been introduced, we have understood they were killed to the ground. In the vicinity of Baltimore they shared a similar fate. But it is a fact worthy of being borne in mind—of being well considered,—that, in every instance where they were killed to the ground, the *Morus Multicaulis* shooted forth with the earliest vegetation of the spring, and grew most vigorously. We passed through a nursery of *two thousand* of them in the early part of September, that had been killed to the ground last winter, which were *then* about 8 feet high, bearing a most luxuriant crop of the most *beautiful, broad*, and *silky leaves*, from the earth to the very verge of their topmost shoots, and presenting at a short distance the appearance of a dense and inseparable body of the most attractive foliage we ever beheld. We have been the more minute in our notice of this variety of the Mulberry, because of the deep interest which has been awakened, in every part of the country, to the importance of the silk culture, and of the character for superiority, over every other of the same family, as food for worms, so universally conceded to it by every one. To those who may enter into the business extensively, where labor is a primary object, the leaf of this tree, does, most certainly, possess an *advantage of immense value*; having no coarse fibres, the worm consumes the *whole of it*, leaving no offal whatever, whereas the leaves of the White Mulberry have at least *one-third*, in stems and gross fibres, that cannot be consumed; which is, of itself, equal to one-third the labor in the gathering of the leaves and feeding the worms—an object of great moment, as we have before remarked, with those extensively engaged in the culture: but it is said that *worms* fed upon the leaves of the *Morus Multicaulis* afford a better silk than those fed on the leaves of the *Morus Alba*, the *White Italian*; that it is more elastic and of richer texture; if these be facts, and we do not pretend to gainsay them, they are strong: and indeed, when taken in connection with the *saving* in food, insurmountable arguments in its favor. We have however seen Italian silk made from worms fed from the White Italian Mulberry, incomparably superior to any China silk we ever beheld; in saying this, we would not wish to be understood as in the least desiring to undervalue the intrinsic excellence of the *Morus Multicaulis*; for our opinion is most decidedly in its favor. If it can be made to accommodate itself to our severe frosts, there can be no two opinions entertained as to its superiority; and that it may be so accommodated, we are equally sanguine. The nursery of which we have just been speaking as containing *two thousand trees*, which were frosted to the earth last winter, is situated in a rich sandy-loam bottom, too moist, we think, for the more delicate exotics, and this we believe, is one great reason why the ravages of the frost were so universal with this interesting Chinese stranger. And if we are right in our conjecture, a remedy is of easy application:—nothing more being necessary than the transplantation of all Mulberry orchards upon hill sides, well protected from the bleak winds of winter, either by woods or board fences—and we need scarcely remark, that *the soil should be dry, sandy, stony, or gravelly*—of this, however, we shall speak more fully in another place. While we are upon this particular branch of our subject, we would suggest that all difficulties with respect to the cultivation of the *Morus Multicaulis* might be obviated by planting a *portion of each orchard with the White Italian Mulberry*. Thus would each culturist be ensured in a supply of leaves from the latter under any adverse circumstances which might occur. The probability is, from all past experience, and particularly during the last winter, that the *roots* of the *Morus Multicaulis will survive any destruction of its branches from cold*, and as it springs up freely in the spring, it would only be necessary to secure a supply of leaves until the new shoots would be sufficiently matured to be deprived of their foliage, without endangering the roots. This could be readily effected through hedges of the *Morus Alba*. By such an arrangement, all apprehension of evil consequences from the destruction of the former would be obviated. If the *Morus Multicaulis* were not killed, the early, as well as subsequent feeding could be carried on from it; if killed, the *Morus Alba* would come in to supply its place until the new vegetation of the Chinese justified food being gathered from it, so that, in either event, the supply of leaves would be secured. We might here be content; but in order that every possible light may be thrown upon this part of the question, one, indeed, involving so many considerations of moment to the future prosperity of the culture, we copy the following article entire from Kendrick's Orchardist—edition 1833, page 286 to 291.

Morus Multicaulis.

A tree of ornament from China—A fruit tree—a new and most valuable species of Mulberry, for the nourishment of the silk worm, which is represented, as possessing such decided superiority over all others, as to be speedily substituted for them in every region of the globe.

This tree has not yet to my knowledge borne fruit in America. It was even unknown in Europe as a fruit tree, till in 1830, for the first time, it produced its fruit in France. The fruit, according to M. Audibert, was produced in great abundance; it was long, black, and of sufficiently beautiful appearance; its taste very good, having a taste intermediate between the red and black

mulberry. The tree is very vigorous and upright in its growth. The leaves, in a light, friable, rich, and humid soil, are large and cordiform, but in a dry and arid soil, they are of less size, eliptical, and without the heart-shaped indentation; their breadth is stated to be six inches, and their length eight; but in rich soils they are sometimes eight inches in breadth, and ten in length, or even more. They are curled or convex on their surface, of a deep shining green, and eminently beautiful.

Some account of this plant so lately introduced to France and to Europe, is contained in the Silk Culturist, No. 2, a valuable work published by Dr. Felix Pascalis, of N. Y. It is contained in a letter to the author from Havre, and is as follows.

"Samuel Perrottet, a member of the Linnean Society of Paris, employed by Government as a travelling Botanist, returned to this port after a voyage of thirty-four months. He brought with him eighty-four boxes of various dimensions, containing one hundred and fifty-eight species of living plants, to the number of five hundred and thirty-four individuals. All these productions had been procured in the seas of Asia, or gathered on the coast, or in the lands of Cayenne. From the commencement of the present century, there had never before been so vast an importation; one so extensive in number, for rare genera, species, and families, and vegetable productions, or their seeds. All of them passed under my examination, and they rather appeared to have come out of a green house than from a ship.

"In this immense collection was the *Morus Multicaulis*, thus called by Perrottet; for the first time ascertained to be the real Chinese Mulberry, *Morus Alba Sinensis*, of which every silk grower and culturist should endeavor to multiply the species. It has been deposited in the Royal Garden. Monsieur Perrottet says that it grows with many shoots from the roots, with tender stems, and large foliage, of a much more nourishing nature than the European mulberry.

"Chinese inhabitants assured him, that to this tree, the disciples of Confucius are indebted for the prosperity and solidity of their empire.

"The *Morus Multicaulis* is already propagating in France and probably will be substituted and preferred to all the other varieties. Among the other qualities of the plant, it is affirmed in China, that a less quantity of this foliage is required for the precious insects, than of that which we are obliged to provide for them. Monsieur P. has left the tree in Cayenne, where it is now flourishing in dry and barren soils."

Remarks on the culture and uses of the Morus Multicaulis by M. Perrottet, Agricultural Botanist, and Traveller of the Marine and Colonies—From the 'Annals of Fromont.'

"The *Morus Multicaulis*, which we noticed for the first time in the *Annales de la Societie Linneene de Paris for* 1824, appears to have originated in the elevated regions of China; from whence it has been disseminated throughout the low plains near the sea shore. It is believed it is cultivated in all parts of that vast empire, where the culture of the silk worms is an object of commercial importance. From Canton it was introduced into Manilla and all the Islands in the Asiatic Archipelago, where it was only cultivated for ornamenting gardens. The Chinese are entitled to the credit of this introduction, who in emigrating from their country have from motives of industry, endeavored to multiply it, that they might render it useful to them, in the new country of their adoption.

"The fortunate discovery of this precious shrub occurred in the garden of a Chinese cultivator at Manilla, who, after having informed us of its properties, and the important purpose for which it was used in his own country, yielded to our solicitations and sold us two bushels for ten Spanish piastres, assuring us that he had introduced it into Manilla, where it had been considerably extended.

"In August we brought it from Manilla, the capital of the Phillipine Islands, and first introduced it into the Isle of Bourbon, from thence into Cayenne and France. At a later period it was sent from Cayenne to Martinique, and from France to Guadaloupe, and also to Senegal, where it has been considerably multiplied. The numerous plants which are already disseminated in the divers climates of Africa, America, and Europe, have been all produced from the two individuals, which we procured at Manilla.

* * * "Among the number of mulberries now cultivated by the Chinese, for the education of silk worms, the *Morus Multicaulis* appears to be the most esteemed of all, not only for the facility with which it is propagated and grows, but still more for the essentially nutritive property which the leaves possess. We have been enabled to verify this important fact during the five years which we passed in Senegal. * * * The characters which essentially distinguish this mulberry from the other varieties, are those which result, 1st, from the remarkable property which the roots possess of throwing up numerous small flexible stalks, without forming a principal trunk; 2d, from the remarkable development which the thin, tender, and soft leaves speedily acquire, and the promptitude with which they are renewed; * * * and 4th, and lastly, from the extraordinary facility with which the stalks and branches strike root, as cuttings, without particular care, even before they have acquired a ligneous consistence.

* * * "Besides the advantages which we have already named, we may still add, that they are admirably calculated for forming regular plantations;

it not being natural to grow tall or form any trunk properly so called; they can be placed very near without an injurious effect; and by heading down the stalks annually near the ground, a rich vegetation is produced, with a complete development of vigorous branches and leaves; and finally it is easy to multiply them by thousands from the roots in the course of a year, and to form vast and regular plantations of them the second. But a few years then are sufficient to obtain considerable fields of them in full vigor, sufficient to support an immense quantity of silk worms, and that with the greatest facility, as they are reproduced in a manner almost indefinite. * * * Regular plantations of it can be formed without difficulty, by planting the shrubs at a distance of six or eight feet from each other, a space sufficient for the extension of the branches, to facilitate the culture and for collecting the leaves. This last operation is so much facilitated by the flexibility of the stalks, that a child is sufficient for furnishing the food of a large establishment of silk worms.

CLIMATE, SOIL, &c.—* * * "This species will be readily acclimated in Europe; because it originated in an analogous region as to climate, to that which we inhabit. It appears not to suffer from the excessive cold of the northern, or the intense heat of the intertropical regions; for the plants deposited in the gardens of the government at Cayenne, acquired in the space of eight months a truly remarkable development, and at the time of our departure from that colony, in June, 1828, they were clothed with leaves of an extraordinary size. Those also which we cultivated at Senegal, although situated under a dry and scorching sun, and planted in an arid soil, offered an appearance sufficiently satisfactory, but they had acquired less development in all respects, than those which have vegetated under the humid climate of Guiana. It appears expedient then, that plantations of this mulberry should be made upon a humid rather than a dry soil, to obtain in all respects a satisfactory result.*

* * * * "Besides, this mulberry braves the most vigorous winters. We saw on our arrival at Havre, in July last, in the field of M. A. Eyries, plants, which had endured, in the open ground, the winter of 1828, and which appeared vigorous and beautiful."—Thus far M. Perrottet.

On this last and other points, let us now hear the testimony of M. Poiteau in the *Annales d'Horticulture*, 1830.

"By the information which we receive from all quarters, it appears, that this mulberry is destined to replace the common white mulberry, everywhere, for nourishing silk worms; its property of continuing low and bushy, so that the leaves can always be gathered without a ladder; and the large size, abundance, and tenderness of the leaves cannot fail to give it a decided preference. It has been sufficiently ascertained, that they are eaten with avidity by the silk worms, and that the silk which they form is of the first quality. This mulberry has not suffered in the least from the rigors of the last severe winter.

"The zealous traveller, who has given to France, America, and Africa, this precious plant, has acquired a just claim to public gratitude, and it is not only easy, but proper, to give him at this time a proof of it, by affixing his name to the tree which has given him celebrity, and which will contribute so much to the prosperity of French industry." * * * *Note to the Perrottet Mulberry*, (*Morus Multicaulis.*)

M. Audibert is also decidedly of the opinion that the best mode of cultivating the *Morus Multicaulis*, for the support of silk worms, is in hedges with low stock. M. Barthere of Toulous in the South of France, who has considerably extended their cultivation, fully coincides in the same opinion; and is confident that in grounds and vineyards which could hardly give two per cent, this tree will now ensure ten per cent.

This tree, according to M. Perrottet and Dr. Deslongchamps, is easily propagated either by layers, by cuttings, or even by cuttings of a single eye, placed beneath the surface and shaded from the noonday sun.

The experiments instituted at Paris by Dr. Deslongchamps, have confirmed all that had been previously asserted respecting the quality of the silk produced by this plant; he has further stated that the cocoons, made by the worms fed only on this plant, are even rather heavier.

Dr. Felix Pascalis in an article in Silliman's Journal of Science for July, 1830, after informing us that in the preceding March he had received two plants of this mulberry from France, has added—"After the discovery of this plant, a doubt no longer exists, that two crops of silk may be raised in a single season."

At Madam Parmentier's Horticultural establishment, two crops of silk were produced in the summer of 1832. The first were fed promiscuously on the *Morus Multicaulis*, *Morus Alba*, and other mulberries. The cocoons thus produced were about two-thirds white and the remainder of an orange color. A suitable portion of these cocoons were collected for seed, having no regard to color:—These being subjected to the hatching process, produced a second crop the 30th July. These last were fed exclusively on the *Morus Multicaulis:* they passed through the different stages of their larva existence in the short space of 26 days. The cocoons which were obtained from this second crop were of a *much larger size* than those of the first crop, but what is of

*[This is contrary to the present experience so far as the quality of the silk is concerned.—Ed. Farmer and Gardener.]

more consequence *they were of the whiteness of snow, and have a most beautiful shining appearance.* (See New England Farmer, vol. xi. No. ii.) At Madam Parmentier's in 1831, I witnessed the silk worms feeding with avidity on the leaves of the *Morus Multicaulis*, and was informed that they had left eleven other species of mulberries to feed on this. At that place we are also informed, the *Morus Multicaulis* has withstood the rigors of the last six winters, uninjured and unprotected. Although being possessed of an active and prolonged vegetation, it is not to be expected that the unripened wood of the tender tips, should always escape.

I introduced this plant to Massachusetts in the spring of 1831, from the Messrs. Prince of the Linnæan Botanic Garden, Flushing; I also received plants of the same from Madame Parmentier's of Brooklyn, L. I. and I have also received them from France from M. Andre Michaux, author of the *American Sylva.*"

Having dwelt so copiously upon the *Morus Multicaulis*, it is but fair that we should speak a little in detail upon the *Morus Alba*, as that must, for some years yet, form the great reliance for food for the worm.

The *White Italian Mulberry*, or the *Morus Alba*, of Linnæus, is a native of Asia, and was introduced into Italy, by some of the survivors of the last crusade. *Oliver de Serres* relates that the French who accompanied Charles the eighth, in his invasion of Italy, in 1494, being struck with the abundance of the trees in that country, and with the profit derived from the culture of silk, caused it to be introduced into France. It is mentioned as a very singular instance of the longevity of this tree, that in 1802, *Faugas de Saint Fond*, saw the original one, around which M. *Lachaux*, to evince his respect for this *monument* of agriculture, and parent of the White Mulberry trees in France, had built a wall, there are several species of this tree, and numerous varieties, the result of cultivation, soil, climate and the play of nature. The forms of the leaves are extremely variable. Mr. *Audibert* an experienced cultivator in France, says, "that the same tree will have leaves divided into several lobes, when young, and, when it becomes old, they will be entire. Others have the second crop of leaves differently formed from the first; some again have entire leaves in the spring, and lobed leaves in the autumn. Hence it is extremely difficult to assign positive characters to the different varieties, particularly when they shew no diversity in appearance, except in the shapes of the leaves. Its superiority over every other variety of the Mulberry except the Morus Multicaulis, consists in this: It is cloathed with leaves *fifteen* or *twenty days* earlier than the others—the silk worms, therefore, come quicker to maturity and are preserved from the inconvenience of the hot season. The White Italian Mulberry, moreover, not only grows more rapidly but has a more abundant foliage, and the leaves are more delicate and more nutritive; whence the silk becomes handsomer and of better quality. But there is a considerable difference in the quality of White Mulberry trees Count *Dandolo*, the great silk rearer of Italy, considers those best that grow in Lombardy, under the name of *Folia Giazzola*, and *Folia Doppia*, the leaf of which contains five different substances: 1st, the fibrous substance; 2d, the coloring matter; 3d, water; 4th, the saccharine substance; and 5th, the resinous substance. The saccharine matter is the most essential part in the nourishment of the silk worm.

As botanists place the White Mulberry tree in the class of dioecious plants, or such as have barren or male flowers on one individual, and fertile or female ones on another of the same species, it is thought by some that it would be convenient to plant exclusively, *male* Mulberries, which they say afford the advantage that, not only on stripping them, the berries do not embarrass the operation, or cause a diminution of its product; but that the worms in their last age, are not exposed to be fed on leaves affected by the glutinous substance of the berries, which would injure their health. Moreover the male trees keep for their foliage all their juices; whence their leaves are in greater quantity, and of a better quality; we, however, believe that there is more fancy,—more theoretical pride—than well grounded opinion in this, and therefore reject it, resting under the firm conviction that no injury whatever can result from the presence of *females* among the males of the tribe.

SOIL AND SITUATION.

The nurseries, as well as the large and small Mulberry plantations, require a sunny exposure, and spots well sheltered against strong cold winds. Therefore, declivities, or hill sides, descending towards the east or southeast and secured by woods or groves, are proper; as also, all spots protected by artificial plantations and buildings. The trees should never be planted in marshy or low ground; 1st, because they would be more exposed than on elevated situations to the injurious influence of cold and frosts, and 2dly, because worms fed from leaves gathered from trees in such situations, owing to the superabundance of aqueous matter in them, do not yield silk either as lustrous or tenacious, and 3dly, from the absence of saccharine matter, the worms are not so healthful, nor do they give as much silk. Next to the soil described, a calcareous sandy clay is to be preferred. A heavy clay, or fenny, marshy earth, are especially unsuitable, because in such situations the bark becomes covered with moss, and the trees are slow in their growth, liable to diseases of the heart, and to be killed

the intense cold of winter, when the plant is young, and before its exterior coating and wood becomes hardened.

A single remark with respect to the soil will be sufficient. If it be not in good tilth. it should be manured in the *hole*, if in standard trees, or in the drill if in hedge rows, with a compost comprised of one-eighth lime, three-eighths mould or decomposed leaves from the woods, one-fourth stable manure, half rotted, and the remaining fourth, leached ashes, to be prepared in a heap, and suffered to remain to mellow three or four months, to be turned up and mixed two or three times in the course of the process. If after the young trees should be set out, a long continued drought should occur, they should be watered two or three times a week.

VARIETIES OF THE WHITE MULBERRY.

The white Mulberry is a tree not known by its fruit. Two varieties bear white berries, one red and another black, and trees have been known to bear different kinds of fruit on the same tree.

METHOD OF SAVING SEED.

As the fruit ripens, the tree should be shaken every morning, and the fruit that falls gathered with that which may have fallen of itself. Put the fruit into a tub and press and rub it till the berries are completely worked into a common mass. They should then be washed in water until the pulp is completely separated from the seed. During the process of washing, the water must be repeatedly changed, and in pouring off the dirty water, the seed which swims must be suffered to escape, as it is not good. When the seed is thus perfectly cleansed and separated, it must be spread on cloths in the shade to dry. When *perfectly dry*, it should be put up in bottles, well corked, which should be kept where they would never be exposed to *light*, *air*, or *dampness*. The White Mulberry seed are of an obtuse triangular shape, and of a dull, dark yellow color, and very full of oil.

MODE OF TESTING SEED.

Soak it in *hot* water a few hours, when the seed which is really good will *sink* to the bottom, the worthless will continue to float on the surface, the latter must be thrown away as it will not vegetate.

PREPARATION OF SEED BEDS—TIME OF SOWING, &c.

1. To sow an ounce of seed, prepare a bed 50 feet long and 4 feet broad. Manure it *well* with a compost composed of one-third stable manure, one-third ashes, and one-third decomposed leaves from the woods, or garden mould; dig *deep*, pulverise finely, and then lay the bed off in drills 12 inches apart, ¼ or ½ of an inch deep; sow the seed as thick as you would that of onions, or parsnips; cover with rich mould, press the mould down gently, but sufficiently to cause the seed to come into contact with the earth; and should the weather be dry, water the seed bed every other evening, it will assist in promoting the germination of the seed and the vigorous growth of the plants.

2. The *best time for sowing the seed* is from the 1st of April to the beginning of May; and, indeed, in favourable situations, if sown as late as the beginning of June, they would succeed; but if sown in the spring, the earlier the better, as the plant will thereby have time to grow to such a size, and the bark become so well hardened, as to offer something like a guaranty to their getting over the first winter, which is decidedly the most critical period with the young plants. If you should determine upon sowing in the spring, turn up your plant-bed deeply the preceding autumn, and let it remain in a rough state, to derive advantage from the fertilizing effects of the winter's frosts, manure in the spring, dig it again, pulverize and rake fine, lay off as above directed in drills, and sow your seed.

Should it not be convenient to sow in the early part of the season, you may do so with perfect security in the *first week of August*; your bed to be thoroughly perpared, by being well manured, turned over with the spade two or three times, and *pulverized and raked well*. Whether sown in the spring, or summer, the bed must be kept clean of weeds, the ground to be stirred occasionally between the drills, receive a watering of a weak solution of soot and water, diluted barnyard water, or soap suds once a week, or fortnight; and, in dry weather, twice a week in addition with water, it being important to push the growth of the young plants the first season. The watering should not be carried on after August. By pursuing this nourishing and forcing course, you may urge your plants so far forward as to be able to transplant the *stronger* ones into nursery beds the ensuing spring after sowing the seed. The *fruit* of the White Mulberry when ripe, if put in the ground whole, in drills, will vegetate immediately, and if the plants be kept *weeded*, and treated as directed above, will be sufficiently advanced to stand the winter with the aid of a slight covering. The first fruit of this tree ripens about June.

The seed should be soaked forty-eight hours in a *solution of soot and hot water* before sowing, drained through a sieve, rolled in plaster and then sowed. An ounce will yield from 5,000 to 8,000 plants.

The first winter the plant-beds must be covered with long stable manure, leaves or straw, to be confined with small twigs of pine or evergreen. Matting will also answer as a covering. This should be put on as soon as the black frosts come, and kept on until the middle of the ensuing April; to be then *removed cautiously*, so as

not to expose the plants too suddenly to the injurious effects of the bleak winds, or frosts of the spring. In covering the plants, care must be taken not to smother them.

3. The second year, if not removed before, the plants must be removed into the nursery rows or beds, which must be prepared as for any other crop. The ragged roots being taken off and the tap root shortened, the plants must be planted out 12 inches apart in rows three feet apart, the earth to be well trodden around the plant. As before, the earth must be kept open and free from weeds, and be watered, as directed, in dry seasons.

4. It may be laid down as a general rule, that the plants when a foot and a half high are fit to be transplanted into the nursery. They should be taken up with great care, without injuring the roots and divided into classes, planting those of a size together. In transplanting them, their roots should be a little shortened, and all tender fibres, which may have been injured by the frost, should be cut off.

5. At two years old, the plants may be planted out into hedges, at 18 inches apart in rows six feet wide. The ground should be prepared as before directed, and some good rich mould put into the holes, to be pressed around the plants. If intended to be planted out as standard trees, 20 feet square apart would be a good distance; but in that case, the plants should not be transplanted until they are about an inch in diameter. In either case they will require trimming and topping, and if kept as hedges should be treated as other hedges are.

6. In every instance before planting in hedges, or standard trees, the ground should previously have had the benefit of a meliorating crop, as potatoes, carrots, parsnips, &c. so that the soil may have been put into the best possible condition for their reception, and in setting them out, the holes or hedge rows, in which they may be placed, should have the advantage of a good rich compost, such as we have prescribed for the seed beds.

7. *Standard trees* should not be placed out permanently until they have attained a height of seven or eight feet.

8. Whether the *Morus Alba* or *Morus Multicaulis* be planted, we believe that the *hedge* form will be found to be the most advantageous as well as convenient mode; the same given quantity of land will produce at least forty per cent. more leaves planted in *hedges*, than in *standard trees*, the *labor* of gathering leaves is fully *one-third* less, and the vegetation is much quicker, and these it will be admitted, are considerations of primary moment; besides these advantages, the trimming which the hedges will annually undergo, will necessarily impart a more acceptable and delicate quality to their foliage. A few *standard trees* should be kept on every estate, and particularly where situated in the interior, for the purpose of keeping up regular supplies of seed, and of making that of leaves doubly secure: plants destined for standard trees should always be selected from among the handsomest and straightest plants.

MANAGEMENT OF STANDARD TREES.

When the plants are grown to the size of one inch in diameter, and from 7 to 8 feet high, they are fit to be planted out in the field where they are permanently to remain; make the holes sufficiently large to admit the roots without difficulty or crowding. The roots should be trimmed, then press the earth around them as it is filled in the hole. The transplantation may either be done in the *spring* as soon as the frost is out of the ground, or in *autumn* just after the fall of the leaf. The latter period is preferred by Mr. Smith, in order to let "the small fibrous roots which convey nourishment to the tree have time to prepare for their functions by the vegetating season the next spring." In planting out standard trees, leave all the buds which the young trees have pushed out on the top, till the following spring, when none are to be left but three or four branches to form the head of the tree—these should be so left as to form a circle round the stem, and that the interior of the tree may be kept open, all buds as they appear on its body should be pinched off for a few years. For several years, the head of the young tree should be thinned out, cutting off such branches as cross others or take the lead of the rest; thus equilibrium in growth, and beauty in appearance, will be effected. Every spring the young trees should be dressed two or three feet around the trunk; and stakes should also be placed by each at the time of planting to ensure straightness, and prevent the ill consequences of being too much agitated by the wind in the early period of their growth.

MANAGEMENT OF HEDGES, &c.

Make your hedge rows, as before directed, 6 feet wide apart, plant the young trees 18 inches apart, taking care that the two lowest buds be in the direction of the *line*, (which should be drawn *straight*) the plant to be cut down to these two buds about half a foot above the ground; by the ensuing spring these buds will have become two beautiful branches, when one of them is to be pruned down to one foot and always on one side of the plant; the branches of the opposite side to be left untouched, but to be bent in the direction of the hedge towards the lopped branches, and fastened to them with willow withs so as to form an arch. The third spring the plants will have branches to form a hedge, when they must be cut about two feet

from the ground, leaving the branches below that point untouched and entire. When plants die, replace them by layers from an adjoining one, as the introduction of new plants hardly ever succeed. The hedge should never be permitted to grow higher than 6 feet, so as to keep it within a convenient height for gathering the leaves. After the leaves have been gathered, the hedge should be pruned, and particularly of such branches as may have been injured or killed, as also each spring, in the beginning of April, the dead branches must be pruned from the living wood with sharp hedge shears, and it should be endeavored at these prunings to give form to the hedge.

OF THE MORUS MULTICAULIS.

What we have said above concerning the transplantation of the Mulberry, has relation to the *Morus Alba* species, and we now propose to give some brief directions with relation to the space to be occupied by the *Morus Multicaulis*, both in the *hedge* and *standard tree* form.

If in *hedges*, they should be planted 8 feet apart in the row, the rows to be six feet asunder.

If as *standard trees*, they should be planted in rows 8 feet wide, the plants 8 feet apart in the row.

This species of the Mulberry partakes more of the character of the shrub than of that of the tree, and, therefore, require less room when planted as standard trees, and more in hedge.

With the difference as to distance above described, the treatment of this tree must be the same as the Italian Mulberry.

Having the subject of the *Morus Multicaulis* again before us, we feel it due alike to ourself, to the public, and to Gideon B. Smith, Esq., to state, that in a recent conversation with that gentleman, he gave it as his opinion, that any one desiring to enter into the silk culture as a business, must abandon every idea of cultivating any other kind than this, as from its superior fitness, in every respect, to the feeding of the worms, it would be impossible that any one growing any other kind could compete with those who fed with it; that as there are no offal from coarse fibres, fully one-third of the labor of gathering will be saved, there being in the other mulberry, leaves of fully that amount of coarse matter which is not consumed by the worms. He says further, that the leaves of the Morus Multicaulis yield a finer silk, more delicate in texture and brilliant in gloss than any other kind. Than the opinion of Mr. Smith, none better need be required, on a matter where he has had experience to form that opinion upon, and, therefore, we should always be cautious in differing on such points with him; but when we look at the brilliant results of the Italian culturists and manufacturers, we are half tempted to believe that the *Morus Alba* makes *good-enough-silk*, though in economy of *labor* the *Morus Multicaulis* is incomparably the superior of all others.

DISTANCE OF HEDGE ROWS.

With respect to the distance between the hedge rows, we are aware that some are of the opinion that they should be sufficiently wide to admit a cart to pass through while the leaves are being gathered, we object to it for these reasons, first, because the pressure from the horse and cart would so beat down the intervening spaces as to have an injurious effect upon the vegetation of the trees, and secondly, because the hedge rows would be liable to be injured by the horse and cart. We think it better that the leaves should be gathered in large baskets, to be conveyed therein to the cart which should be conveniently stationed for that purpose.

OF MODES OF MULTIPLYING.

The means of propagating the Mulberry are various, viz:—*from seed which is the best*, as previously described, by *grafting* and *budding*; from *layers*, *cuttings* and *suckers*.

GRAFTING.

It may be done on the stocks in the nursery, or on the small limbs of trees. *The proper season for it is just before the leaves begin to open in spring.* The head of the stock must be cut off sloping, and a slit made sloping the opposite way, deep enough to receive the scion, which should be cut like a wedge, with the outside thicker than the inner. The rind of the scion must exactly join the rind of the stock. The slit should be opened by a wedge of hard wood; the scion should then be gently put in its place and the stock closed. After this the whole must be daubed round with a mortar made of a mixture of loam and fresh horse-dung, so as completely to exclude the access of air; and this mortar must be surrounded by tow or old cloths to prevent it from being washed away. The scion should be covered nearly to the top with this mortar, and it should also extend two or three inches downwards round the stock. In place of this mortar, Forsyth recommends a plaister made of pitch, turpentine and beeswax.

BUDDING.

Provide yourself with a sharp knife, with *a flat thin haft*, and some bass-matting, or corn husk strings; let these be soaked and in readiness. Then select a smooth part of the stock as high as you intend budding: make a horizontal cut across the stock as deep as the firm wood, and then from the centre of it make an incision downwards about an inch; then take the haft of your knife, and raise the skin on either side of the incision. Then take your knife and cut your bud, which is done in this way. Take your knife, place it about half an inch below the bud, cut slightly into the pith or wood, so as to go below the heart

of the bud, cut upwards to the same distance beyond the bud, then cut the bud out, trim off the leaves, insert your bud by raising the rind and shoving it down so as to close both sides of the skin on it, joining it closely to the upper edge or horizontal cut. Then take your bass or corn husk string, and bind it close around every part, except over the eye or bud, which is to be carefully left out and preserved, and continue it a little above the horizontal cut, not binding it too tight, but sufficiently so to keep the parts close, *exclude the air, sun and wet;* finish by making the ligature fast. At the expiration of a month loosen the bandages. In the March following, the heads of all those which have taken, must be cut off just above the part where the bud was inserted.

LAYERS.

Having dug the ground well and made it light, take some of the most flexible and free growing *shoots, slit the shoot* underneath a joint or bud, up the middle, and about an inch long, or a little better, according to the size and nature of the layer, forming a sort of tongue, laying the part in the earth and raising the top upright so as thereby to separate the tongue of the slit from the other part and keep it open; peg the shoot down with a two pronged stick, leaving about 6 inches out of the ground, in an erect position, then cover up with a rich mould, pressing down the earth. The shoots should be layed down in *July* and *August* and may be taken up or cut off the ensuing autumn, or following spring, when they should be planted out.

CUTTINGS.

Cuttings should be taken off with a sharp knife from shoots of the previous summer's growth. They should be from 6 to 15 inches in length, and should, in all cases where practicable, have a portion of old wood attached to the end to be put in the ground. Let them be planted in a nursery bed, *well manured,* in rows 18 inches apart, the cuttings 9 inches asunder. They should be taken from the tree between the falling of the leaf in the fall and the swelling of the bud in the spring. In planting, they must be placed two-thirds their own length in the ground, great care being taken to press the ground well around them. In dry weather they must be watered well, say twice a week, be always kept clean of weeds, and have the earth stirred two or three times in the course of the summer and spring. The cuttings when taken from the tree should be wrapped up in a matting, or put away in dry sand in a dark cellar, and kept until the opening of spring, when they should be planted out, in somewhat a slanting position. If attended to and forced by occasional waterings with suds or the drainings of dung, they will be fit to transplant the second spring thereafter, either in hedges or orchards.

SUCKERS.

Those should be separated from the parent plant early in the spring, each with some roots; if of sufficient size, they may immediately be placed in their permanent position; if not let them be put into a nursery bed, two feet apart, where they are to remain until their size indicates the propriety of the removal. They must in either case be treated as seedlings or cuttings with respect to being kept clean and watered.

EARLY SUPPLY OF LEAVES.

In order to provide against every possible casualty from frosts, and to secure an early supply of leaves for the worms on their first hatching, the culturist should place a hedge in some warm situation, say a southern exposure, well protected from the northern and western winds, and in the spring, early, they should have a covering of plaited straw or matting to protect them from the frost at night. As the worms in their first feeding consume but little, this hedge might be located on a garden border, and as it would only be used for a few days, it would during the rest of the season form a very pretty ornament to the garden: seed might also be sown broadcast or in drills, in a forcing border, or hot bed, to be in readiness to meet the first calls of the worms for food. There are also other resources to which the agriculturist might resort for the early feeding of his worms, whenever their hatching may anticipate the leaf of the Mulberry. Lettuce, Dandelion, the White Raspberry, and the dry leaves of the Mulberry, of the preceding year, reduced to powder, moistened lightly with water, have all been found to answer the purpose of temporary feeding; but the use of either should only be adopted in the event of the hatching of the worms before the appearance of the Mulberry leaves, which should be sedulously guarded against, by carefully keeping the eggs in such a temperature and location as will delay the coming forth of the worms until there is a regular supply of food to sustain them.

DIVISION HEDGES.

Where ground is an object, the White Mulberry might be made to perform the place of division fences; if planted along the fences and wattled in with the rails, in a few years they would form not only a very beautiful but a *permanent living-fence*, as when they once fairly take a start, it is impossible to eradicate them, even with the aid of the grubbing hoe and the pick axe; for trees which had been cut down upwards of twenty years have been known to throw up young shoots every spring, thus manifesting a tenacity for life which render them invaluable as live-fences. It has been ascertained that if the Mulburry be protected from cattle for two or three years, all further protection will be unnecessary, as the biting off of the young twigs in

spring by cattle, is rather a service than a disservice. Hedges intended for the joint purpose of fences and food, should be trimmed as before prescribed, and be kept at about 6 feet high.

PRUNING.

It is said by some that a judicious pruning of *standard* Mulberry trees should take place every three or four years; but we incline to the belief, that to render it proper, at any time, the necessity for removing unnecessary limbs or branches must exist, and of this, the culturist must necessarily be left to judge for himself. In the spring, say about the beginning of April, all dead branches or limbs ought to be removed from the living wood, care being observed to let the taking off of the branch or limb, be done with a sharp instrument, so as to leave a smooth surface, which should be smeared over with a mixture of three-fourths fresh cow-dung and one-fourth chalk, moistened to a proper consistence.

It may be assumed, in addition to the pruning above recommended, that always after the gathering of the leaves of the season shall have been done with, all the branches that may have been damaged in the operation, and all the dead ones, ought to be lopped off, as well as those the vegetation of which seems too low; and those the vegetation of which on the contrary is too luxurient, ought to be restrained in that propensity or trained in an oblique direction, which is a means of restraining a too rapid growth: they ought not to be left to grow to an excessive height, nor to spread too far. The branches which obstruct the development of the head, or hang too much down, should be shortened; and lastly those that have been thrust out of their natural direction, during the gathering of the leaves, ought to be set right again. As a general remark it may be safe to add, that they should be treated in the main as fruit trees are.

GENERAL REMARKS,

AS TO THE MODE OF MULTIPLYING.

We have given succinct directions with respect to the various methods by which the Mulberry may be propagated; but, as a general rule, we should prefer the growing of the tree from seed to any other form, and in this opinion, we are backed by the experience of that eminent Italian culturist, Count *Dandolo*. He says:

"The leaf of the [seedling] tree, contains the proportion of both the nutritive and silky substances. I have, says he, ascertained the following facts:

1. That 14½ lbs. of wild Mulberry leaves, will produce a pound and a half of cocoons; while 20¾ lbs. of the leaves of the grafted Mulberry, are required to yield the same quantity.

2. That 7½ lbs. of cocoons, proceeding from silk worms fed on leaves of Wild Mulberry give about 14 oz. of very fine silk; whilst generally the same weight of silk worms, fed with the leaves of the grafted Mulberry, only yield eleven or twelve ounces of silk.

3. That the silk worms fed on the wild leaves, are always brisker and have better appetites.

The result is, that, taking two trees of equal age and vigor, the grafted tree yields 50 lbs. of leaves, and the wild tree only 30 lbs; the weight of nutritious substance will be nearly equal in each."

To this authority may be added that of M. *Martleroy*, an experienced culturist in France, who found that silk worms fed with the leaves of the *seedling* Mulberry tree, were more healthy, vigorous, and less subject to diseases, than those which are fed upon the leaves of the grafted trees.

The term "wild trees" as used by Count *Dandolo*, must be understood, in every instance, to mean trees raised from the seed, being used in contradistinction to those propagated by the other appliances of the trade, used in the propagation of valuable plants, and in addition to these reasons, we believe the seedling will be found to be more thrifty, luxuriant in foliage, and longer lived.

Indeed, with such facilities as are possessed in our country for multiplying the Mulberry tree from seed, no inducement exists to a resort to any of the numerous other methods of propagation. It may, perhaps, be said that seed of the *Morus Multicaulis* cannot at present be obtained in America, and that recourse must, of course, be had to those other means of multiplying that species; that, for the time being is true; but then, we think it more than probable, that by the time the spring opens, seed will have been procured from the European markets, and that in a very few years, seed will be obtained in our own, from trees already growing here.

AS TO THE TIME OF SOWING SEED.

In our variable climate, it is almost impossible to fix any thing like a *day* for the sowing of seed in the spring; for it is out of the question, to calculate with any degree of certainty, upon any considerable number of successive days of congenial temperature. Under such circumstances, all we can do, is, to prescribe general rules of government; and in the furtherance of our views, we would say—that the seed should be sown as early in the spring as the *ground and weather will permit*. Say, in winters and springs of ordinary mildness—in the more *southern states*, about the *1st of April*—in the western, from the 15th of *April* to the 1st *June*—in the *middle states* from the 1st of *April* to the 1st of *May*, in forward springs—in backward springs, from the 15th of *April* to the 15th of *May*, and in the *northern* and *eastern states*, from the 1st of *May*, forward during that month, as may be indicated by the weather.

AS TO SOIL.

It may not be inopportune here to make a few general remarks upon the subject of *soil*. Although the young trees for the first year or two, would be evidently improved in their growth by being placed in rich dry loamy soil, yet all experience proves that the plant after it shall have attained a few years of age, grows luxuriantly in every kind of soil. Mr. Smith has seen the tree in every variety of soil, from the poorest to the richest, and has been able to observe no other difference in its foliage than a more firm texture in that which grew on poor land, than in that reared on rich; and it is uniformly admitted that a dry, stony or sandy soil, is preferable to a rich one.

Here a remark presents itself to our mind, which we feel bound in duty to make. It is known to every intelligeat man, that in each county of most of the old states, there are thousands and tens of thousands of acres of worn-out lands, which are either grown over with scrubby oaks, or pines, or covered with that emblem of a heart-broken soil, the sedge-grass. Such fields,—barren and worthless as they may seem in the eye of one who has been used to looking at fields dressed in their brightest and mo·t luxuriant array of verdure,—may all be converted into sources of wealth, by being formed into Mulberry plantations or orchards; by simply manuring the young plants in the drill, in case of hedges, or in the holes in the event of standard trees, with rich compost or loam, or even by manuring with half rotten stable or barn-yard manure; and it should be recollected, that when once started in this way, the young Mulberry will require scarcely any thing further from the hands of the cultivator, but to keep it clean and watered, as may be seen in our remarks under the preceding heads. All the subsequont manuring, whether they be planted in hedges, or in standard trees, which they will require, will more than repay him by their yield for all the labour he may put upon them. A crop of potatoes, occasionally, well manured between the rows, followed by clover, which can be cut one year and ploughed in the next, will be all that will be necessary to secure to the trees, permanent, vigorous growth, and plentiful produce of foliage.

AS TO MODE OF CULTIVATION.

As we have before remarked, we prefer the *hedge form*, and would keep no more standard trees than might be necessary to secure supplies of seed, to meet contingencies.

PERIOD WHEN LEAVES MAY BE FED.

The trees should not be deprived of their leaves until the *fourth* year, and then they should not be entirely stripped; on the following year, however, and the succeeding ones, they may be treated as old trees, and all the leaves be taken off when required for the food of worms; an acre in the hedge form, would, we believe, furnish sufficient foliage, after the fourth year, to support the number of worms requisite to produce the quantity of silk, which forms the basis of the calculations to be found under the proper head. It is best, however, not to be too anxious in pulling them before the plant has received some solidity, and been placed in a situation to withstand any violent demand upon its powers of production, as by judicious attention for a year or two, and a proper consulting of the demands of nature, the tree will receive such an impetus as will ensure to it a long life and luxuriant foliage.

Some of the culturists in the eastern states, are of opinion that leaves may be gathered at two years old, provided those near the end of the branches are left and the main stem be not touched. Our opinion is, that such practice is contrary to nature, and cannot be justified upon any principles connected with reason or a just economy of vegetable life. "Leaves," it has been very happily said, "bear the same relation to trees and plants, as the lungs to the bodies of men and animals. A leafless tree dies soon;" and, therefore, that "not more than half of its leaves, or at most two-thirds of them should be stripped."

YIELD OF FOLIAGE—PROFIT OF THE CULTURE, &c.

It is impossibe to ascertain with any thing like accuracy the quantity of leaves which an acre of Mulberry trees will yield; but still we can approximate sufficiently near to found a calculation upon it. We will here array some of the various authorities upon this branch of the subject.

1. It is stated in the *Memoir* submitted by Mr. *Bailiff Hout*, of Manheim, to the *Agricultural Society of the Grand Dutchy of Baden*, that a White Mulberry tree, 20 years old, planted in a proper soil, produces on an average, two quintals of foliage, (200 lbs.,) and that seven quintals, 700 lbs., are required for 40 lbs. of cocoons.

2. It is computed by Mr. D'Homergue that each tree [standard] at 6 years of age will yield 30 lbs. of leaves, which he proposes should be set at 6 feet square apart, properly cultivated and nurtured.

3. The *Editor* of this Manual, assumes the following, it being the best result at which his mind could arrive, after the most careful examination of various authorities—that is, that a tree, as a standard, four years of age, well cultivated, will yield 20 lbs. of foliage, that at 6 years of age it will yield 30 lbs., and that if planted in *hedge-form*, an acre of land will yield an amount of leaves when six years of age more than equal to the support of 540,000 worms, that is he believes that each tree at 4 years, will yield 4 bls. of leaves, and at 6 years will yield 7 lbs. of leaves, and that its capacity to yield will increase by the time the hedge shall have attained

its twentieth year, 100 per cent., that is, that the acre will, after the expiration of that period, yield a foliage competent to the sustenance of upwards of a million of worms, and this will not be doubted, when it is considered that the acre in hedge-form, six feet wide apart and 1½ asunder in the rows, will contain 4,840 plants—as 6 X 1½ is equal to the square of 9, and that being divided into 43,560, the unmber of square feet in an acre, gives 4,840, as:

9)43.560

4,840 No. plants on an acre 6 feet by 1½.

Mr. *Frost*, of Massachusetts, fed 1,500 worms on 75 lbs. of leaves, which precisely corresponds with the average of food as laid down by Count *Von Hazzi*, of Munich. He says:

On an average *twenty thousand* worms require

in the 1st period		5	lbs. of leaves
2d	"	15	"
3d	"	46	"
4th	"	139	"
5th	"	795	"
		lbs. 1,000	

And he observes, further, that

"Until lately, twice as much would have been consumed in Germany, in consequence of the errors which attended the rearing of worms, their feeding, the economy of the leaves," &c.

Count *Dandola* estimates that about 37 lbs. 12 oz. will feed 1,000 worms, but we take the larger number, as we wish to make a liberal allowance for wasteage and other contingences.

4. Mr. *Fitch* speaks of a full grown tree, which yielded food for worms, which *made four pounds of silk*, and as 3,000 is the *general average* for a pound of silk, there must have been 12,000 fed on this one tree.

Mr. Fitch also states, that an acre of full grown trees, set one and a half rods apart, will produce 40 lbs. of silk.

4. Mr. Tufts confirms this calculation, but does not state the distance at which the trees stood from one another.

6. Mr. Storrs says, that a full grown tree will feed 6,000 worms, which will produce one and a half pounds of silk. An acre of trees will produce 60 lbs. of raw silk in one season.

7. Mr. *Smith* states, that a full grown tree will feed 5,000 worms.

8. Mr. *R. Falley*, now of Ohio, had 18 lbs. of silk from about 100 trees, *part of which were young*, in Massachusetts,"

9. It is stated in the Columbian Magazine, that in the year 1789, nearly four pounds were produced from seven trees, and one pound from eight trees, eight years old, from the seed.

10. According to Count *Dandolo*, it is a certain fact, that, if silk worms are well managed, 21 lbs. of Mulberry leaves will be sufficient to obtain a pound and a half of cocoons, and that in Dalmatia he obtained a pound and a half of cocoons from 15 lbs. of leaves, which yielded a pound and a half of silk, and he further affirms that 97½ lbs. of leaves will produce 7½ lbs. of cocoons. For the yield of the trees we take Bailiff Hout's estimate, 200 lbs. of leaves to the full grown tree.

11. Miss *Rhodes* could scarcely support ten thousand worms on the leaves of twelve large trees in England.

12. According to *Lambruschini*, 100 lbs. of clear leaves will feed worms which will produce 6 lbs. of silk.

13. Mr. *Genet*, the former French Minister to this country, in his *Memoirs* on the subject of silk states, that "A *small hedge* that will occupy the twentieth part of an acre, being planted with bushes not more than three years old will supply and accommodate 100,000 worms, the produce of which will be thirty pounds of raw drawn silk, and if the whole acre is planted in the same way, the produce will be six hundred pounds, which if merely spun into sowing silk would amount at the present price of American sewing silk at Albany, [then] three dollars per pound, to $1,800."

14. Mr. *Daniel Bradley*, of Marcellus, New York, estimates that an acre of ground will yield foliage enough for a *million* of worms, and that some go so far as to say that it will support two millions.

15. On the authority of the Hamilton County (Ohio) Agricultural Society, as we have before stated, it is affirmed that four young ladies in Massachusetts, gathered as many leaves off of 4 acres in 1833, as fed worms which made them 420 lbs. of silk, besides attending to the domestic concerns of the household.

16. The late Mr. *Parmentier*, of New York, a distinguished Nursery-man and Horticulturist, stated that an acre of Mulberry trees, when full grown, would yield foliage enough to feed worms that would produce 490 dollars worth of silk.

REMARKS UPON THE PRECEDING.

We have prepared in a succeeding page, a table, shewing the produce per acre, according to the respective statements and data of the several persons given under the preceding head, and in order that the reader may understand the principles upon which our several calculations are made, we will briefly explain each, as they respectively stand in numerical order.

No. 1. Mr. *Hout* states that a tree 20 years old will yield 200 lbs. of foliage, and we calculate, as 108 trees, 20 feet square apart, can stand on an acre of ground, the acre will yield 21,600 lbs. of leaves. Again he says, 700 lbs. of leaves will produce 40 lbs. of cocoons, and, therefore, 21,600 lbs. will produce 1234 lbs.; then, as 9

lbs. of cocoons are equal to 1 lb. of silk, so is 1234 lbs. equal to 137 lbs.

No. 2. This is calculated upon the same principle as the first branch of the above, with this difference, that the 6 feet square assumed by Mr. *D'Homergue*, will give 1210 trees to the acre —the square of 6 being 36, that divided into 43,560, the number of square feet contained therein, gives 1210 as the quotient.

No. 3. *Our own* calculation is based on a similar principle.

No. 4. Mr. *Fitch's* statements do not accord with each other, and we have, therefore, undertaken to reconcile their discrepancies. In the first place, he speaks of having seen a *full grown* tree that afforded food for worms, which made 4 lbs. of silk: then he tells us that an acre of *full grown* trees set a rood and a half apart, will produce 40 lbs. of silk. Now as a rood and a half is 24 feet, 75 trees can be set upon an acre, and unless Mr. Fitch has *two measures* for his *full grown* trees, he is not consistent with himself, as, 75 such full grown ones as he first describes, would yield 300 lbs. of silk, instead of 40. The first tree he names must have fed 12,000 worms; but if we calculate that his subsequent ones are competent to feed 5,000, the most generally received number, the 75 must have produced 125 lbs. of silk. It struck us however as most fair to take the *average* of the three, and we accordingly made our calculations upon that data.

No. 5. Mr. Tufts having avouched Mr. Fitch's statement, we have made the same calculations for him.

No. 6. Mr. Storrs estimates that it will take 4,000 worms to make a pound of silk; this is much too high; 2,400, 2,542, 2,700 and 3,000 have severally done so; but he has even set the produce of an acre at greatly below what his extravagant estimate would make it. We believe we make a liberal allowance for contingencies, when we assume 3,000 as the number competent to give a pound of silk; we have, therefore, found our average, by calculating the pound at that ratio; at Mr. Storr's 4,000, and then at his 60 lbs. per acre.

No. 7. We take Mr. Smith's estimate of the capacity of a full grown tree, and Mr. Bradley's for the measure of that of the worms, and thus arrive at the result in the table.

No. 8. We take this as we find it, though it is evidently made with too much looseness to entitle it to the least consideration, and but that we wish to show both sides of the picture, we would not give it.

No. 9. Here too, there is much looseness; but to prevent cavil have placed the trees 20 feet square apart, and thus find a result much below what the data would justify.

No. 10. Count *Dandolo* gives data for three calculations, and as his great experience in the business, enlightened mind, and mathematical exactitude in all that he does, entitle his statements to every consideration, we have made calculations for each and taken the average, viz: 171, 184 and 240=595 aggregate—average 198⅓, and we are pleased to find that this is 17⅓ lbs. more than our own; for from the familiarity of this distinguished gentleman with the business, the utmost reliance may be placed on his estimates; because they are the results of actual practice.

No. 11. Miss Rhodes' experiments being made in England, where the worms will *not labor*, should not be taken into the account; for England has long since abandoned the culture, having given it up as utterly impracticable owing to the humidity of the climate;—but as our object is truth, we give it for what it is worth.

No. 12. This is a high-pressure calculation, which never *has been*, and, in our opinion, never *can be realized*: we are, therefore, disposed to think that, in the *translation*, the word "*silk*" has been substituted for that of "*cocoons*"—with this changed version, it would approach much nearer practicable results.

No. 13. This author is also too high, in our opinion, though he has several good authorities to back his calculations withal.

No. 14. This a little too sanguine also.

No. 15. This being an actual result, is of course, to be taken for its *actual* amount, and although less than an acre is capable of producing by nearly a hundred per cent., it is a most wonderful product, all things considered.

No. 16. This, in our opinion, is much below what can be realized from an acre properly cultivated.

Recapitulation.—A table shewing the probable produce per acre according to the estimates and data furnished by the 16 different persons enumerated therein, made upon the principles as explained in the preceding remarks.

No. as per list above.	Names of the Parties.	Estimated No. of pounds of Silk.	Value of Silk per pound.	Amounts.
1	Mr. Bailiff Hout,	137	$4	$548
2	Mr. D'Homergue,	242	4	968
3	The Editor,	180	4	720
4	Mr. Fitch,	155	4	620
5	Mr. Tufts,	155	4	620
6	Mr. Storrs,	146	4	584
7	Mr. Smith, as explained	180	4	720
8	Mr. Falley,	18	4	72
9	Columbian Magazine,	61	4	244
10	Count Dandolo, aver.	198	4	792
11	Miss Rhodes,	27	4	108
12	M. Lambruschina,	1296	4	5184
13	Mr. Genet,	666	4	2664
14	Mr. Bradley,	333	4	1332
15	4 Massachusetts' ladies,	105	4	420
16	Mr. Parmentier,			490
	Totals.	3989		16,086
	Total of all the estimates,			$ 16,084
	Average product per acre,			$1005

We now propose to make a few calculations, in order that the reader may more fully comprehend the table just given, and those which may follow.

It is computed by Mr. D'Homergue, that a tree 6 years old, will yield 30 lbs. of foliage, and that they may be planted 6 feet square apart, which would give us 1,210 trees on an acre, there being 43,560 square feet in an acre, as

6
6

Square of 6, 36) 43560 (1210 No. of trees on an acre at 6 ft. square apart.
36
75
72
36
36
0

Thus then, if there be 1,210 trees on an acre, yielding 30 lbs. of leaves to the tree, they will give foliage enough to support 726,000 worms, and as 3,000 cocoons will yield a pound of silk, so will the gross number give 243 lbs., as for examples:

1210 trees on an acre,
30 lbs. foliage to each tree,

36,300 lbs. of leaves on an acre.

It has been proved by the actual experiments of several silk culturists, indeed, we might say, by *universal* experience, that 50 lbs. of leaves will support 1,000 worms during the feeding season.

The question may be therefore thus stated:

If 50 lbs. of leaves feed 1,000 worms, how many worms will 36,300 lbs. of leaves feed.

If 50—1000—36,300
1000

5,0) 36,30000,0
726,000 worms.

Again, if 3,000 cocoons make a pound of silk, how many pounds will 726,000 make.

If 3,000—1—726,000
1

3,000) 726,000

Amount raised on an acre according to Mr. D'Homergue's statement, } 242 lbs. of silk.
4$ per lb. present selling price

Gross value of an acre in silk culture, } 968$

We have no doubt, ourself, that this amount might be realized, and even more, from an acre in the silk culture, properly attended to, in the hedge-form, but as we do not wish to excite over sanguine expectations, *we* have assumed *data* even less than that justified by the actual experiments, or rather practical business results, of Count *Dandolo*, one of the most intelligent among the Italian silk culturists. The following examples will show the amounts produced by that gentleman, according to his statement, as per No. 10 in the table.

There being 108 trees on an acre, each bearing 200 lbs. of leaves, the whole will yield 21,600 lbs. of foliage, as

108 number of trees on an acre
200 number of pounds per each tree

21,600 lbs. the produce of an acre.

As Count Dandolo says, that 21 lbs. of leaves will yield 1½ lbs. cocoons, so will 21,600 lbs. of leaves give 171 lbs. of cocoons; as

If 21——1½——21,600
2 3

3 21) 64800

2) 3085

1542 lbs. of co's.

As 9 lbs. of cocoons give 1 lb. of silk, so will 1542 lbs. of cocoons yield 171 lbs. of silk; as

If 9—1—1542
1

9) 1542

171 lbs. of silk.

Again—Count Dandolo has obtained 1½ lbs. of cocoons from 15 lbs. of leaves: this will give us the following as the product of an acre's culture.

If 15——1½——21,600
2 3

3 15) 64800

2) 4320

9) 2160

240

And again—he says, that 97½ lbs. of leaves

will produce 7½ lbs. of cocoons—this gives us the following result:

97½ — 7½ — 21,600
2 2 2

195 15 43200
15

216000
43200

195) 648000

2) 3328

9) 1664

184 lbs. of silk.

Product of the several results.

171
240
184

3) 595

Average product of an acre according to Count Dandolo, } 198 lbs. of silk at $4 per lb.—$792.

Our own calculation is predicated upon the statement of Mr. Smith, that a full grown tree will yield foliage enough for 5,000 worms, and as 108 trees at 20 feet square apart will stand on an acre, so will that number of trees support 540,000 worms, and as 3,000 will make a pound of silk, so will 540,000 make 180 lbs., as per example:

108 No. of trees on an acre,
5000 No. of worms which one full grown tree will support,

3,000) 540,000

180 lbs. of silk raised from an acre,
4

$720 the gross value of an acre.

We will now state an account current, by which the nett profit of an acre will be clearly demonstrated, and we beg leave to make this explanation, that, with a view of providing against all possible contingencies, we have taxed 540,000 worms with the expense of the *labor* of 1,000,000, which will more than cover all drawbacks arising from mortality among the worms, or any other unforseen casualties.

Dr. 1 *Acre in Silk Culture, in Account with A. B.* *Cr.*

Interest on 1 acre land, valued at $20 at 6 per cent.	$1 20	By 180 lbs. of Silk at $4 per lb.	$720 00
Interest on laboratory, valued at $500 at 6 per ct.	30 00		
Hire of 2 men 5 weeks at $6 per month each,	15 00		
Their board at 1½ per week,	15 00		
Hire of 2 women 4 weeks, at $3 per month,	6 00		
Their board at $1½ per week,	12 00		
Hire of 4 women 5 weeks at $3 per week,	9 00		
Their board at $1½ per week,	18 00		
Hire of 12 children from 7 to 14 years old, 2 weeks at $1 per week,	24 00		
Their board at $1 per week,	24 00		
Balance as per contra,	$565 80		
	$720 00		$720 00
		By balance or clear profit on 1 acre in the Silk culture,	$565 80

Having thus demonstrated the practicability of realizing $565 80 cents, from one acre in the silk culture, well attended to, on which, however, an excess of labor equal to 46 per cent., or on which the cost of the labor necessary for 1,000,000 is charged upon 540,000 worms, we will now prepare a *table*, shewing the nett profits on from 1 to 10 acres, the same excess of labor being charged, the object of which, is, to cover any contingent demands which may be made upon the product of the worms, whether by mortality or otherwise.

A Table showing the nett profit of the Silk culture from 1 to 10 acres, both inclusive, as demonstrated by actual results, the expense of labour however, being charged as aforesaid in the ratio of 46 per cent in excess.

	Product of 1 acre.	Product of 2 acres.	Product of 3 acres.	Product of 4 acres.	Product of 5 acres.	Product of 6 acres.	Product of 7 acres.	Product of 8 acres.	Product of 9 acres.	Product of 10 acres.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Gross product,	720 00	1,440 00	2,160 00	2,880 00	3,600 00	4,320 00	5,040 00	5,760 00	6,480 00	7,200 00
Cost of culture,	154 20	308 40	462 60	616 80	771 00	925 20	1,079 40	1,233 60	1,387 80	1,542 00
Nett profit, $	565 80	1,131 60	1,697 40	2,263 20	2,829 00	3,394 80	3,960 60	4,526 40	5,092 20	5,658 00

We will now, for the better satisfaction of the reader who may desire to be thoroughly informed with respect to *actual* profits, without the trouble of reducing the data given to calculation, prepare a table, showing the exact profit upon 1, 5 and 10 acres in the Mulberry culture, according to the data furnished by Mr. D'Homergue, that of Count *Dandolo*, and *ourself*, the *actual* cost of labor being charged.

A Table showing the actual profits of the Mulberry culture upon 1, 5 and 10 acres, according to the estimates of Mr. D'Homergue, Count Dandolo, and the Author of this Manual.

	Calculation according to Mr. *D'Homergue's* data.			Calculation according to Count *Dandolo's* estimate.			Estimate of the Author of this Manual.		
	1 acre.	5 acres.	10 acres.	1 acre.	5 acres.	10 acres.	1 acre.	5 acres.	10 acres.
Gross product, $	972 00	4,860 00	9,712 00	792 00	3,960 00	7,920 00	720 00	3,600 00	7,200 00
Cost of Culture,	111 94	559 70	1,119 40	85 10	425 50	851 00	83 26	416 30	832 60
Nett profit, $	860 26	4,300 30	7,592 61	707 90	3,534 50	7,069 00	636 74	3,183 70	6,367 40

As we desire to be fully understood upon this important branch of the subject, we will enter somewhat more at large upon it. We ask leave then, in the first instance, to remind the reader that we have assumed the ability of an acre of ground in Mulberry trees, six years old, to sustain 540,000 worms. This number is *arbitrary*, it may be said, and so it is, as also is that of the yield of single trees; but they are both in our estimation low. We believe that if a *standard* tree 20 years old, will yield 200 lbs. of foliage, it is a moderate calculation to say that one in the hedge row at 4 years old will give 4 lbs., and that at 6 it will yield 7 lbs. Mr. D'Homergue estimates that a *standard* tree of the same age will yield 30 lbs., and when we

claim less than *one-fifth* for it in the hedge, we think we must be thought moderate.

The acre as we have before shown, in the *hedge-form*, will contain 4840 trees, which when 4 years old, at 4 lbs. of leaves to each, will produce 19,360 lbs. of leaves, and feed 387,200 worms, as 50 pounds will support 1,000 during the feeding season.

4,840
4
19,360
1000
5,0) 1936000,0
387,200 worms.

At 6 years old, according to our assumption, the following will be the result:

4,840 trees on an acre of hedge,
7 lbs. of foliage per each,
33,880 lbs. of foliage upon an acre,
1000
5,0) 33,88000,0
677,600
540,000 number of assumed by us,
137,600 excess over our calculation.

It would thus appear evident, that if the trees at 6 years old should yield the quantity of leaves assumed by us, an acre of land will afford foliage enough to support 137,600, or *one-fourth* more worms than we have claimed for it, which would, as 3,000 give a pound of silk, make a difference in favor of an acre in silk culture, over our preceding estimate, of upwards of 45 lbs. of silk, or, at the rate of $4 per lb., of $180.

It may be said, that all calculations which fix the number of pounds of foliage to be produced by a Mulberry tree, must necessarily be uncertain, and equally so is the assumption that a tree will yield food for any given number of worms. But then in both of these forms we must be governed by the experience of such culturists as reliance may be placed upon. Count *De Hazzi*, says, that "it is now exactly known, from long experience, what quantity of food the worms require in their several ages, until they have begun to spin their silk. Twenty thousand worms correspond to one ounce of eggs of our weight, and they require through all their ages a thousand pounds of leaves." From 18 to 20 good Mulberry trees give, each, one quintal and a half of leaves, and consequently, from 8 to 10 trees are necessary for twenty thousand worms. From the concurrent testimony of almost all the writers, from 37 to 50 lbs. of leaves is consumed during the feeding season by a thousand worms, and having taken the *largest* average, we feel certain that we cannot at all events be considered as exaggerating profits.

TABLE OF DISTANCES.

A table showing the number of plants on an acre at certain distances, there being 43,560 square feet in an acre.

Feet		*feet*	*plants.*
1½	by	6	4,840
1½	by	8	3,630
2	by	6	3,630
3	by	6	2,420
3	by	8	1,815
4	by	4	2,722
6	by	6	1,210
6	by	8	907
8	by	8	686
10	by	10	435
10	by	12	363
12	by	12	302
12	by	15	242
15	by	15	193
15	by	20	145
20	by	20	108
20	by	25	87
24	by	24	75
25	by	25	69
25	by	30	58
30	by	30	40
30	by	40	36

TABLE OF MEASURES.

14 oz. cocoons produce about 1 oz. eggs.
68 eggs weigh 1 grain.

1 oz. contains	22,640	eggs.*
5 ounces,	113,200	"
10 ounces,	226,400	"
15 ounces,	339,600	"
20 ounces,	452,800	"
40 ounces,	905,600	"
80 ounces,	1,811,200	"

1,000 worms consume 50 lbs. of leaves,†
9 lbs. of cocoons will make about 1 lb. of silk,
3000 cocoons make about 1 lb. of silk.‡
800 cocoons make about 1 lb. of cocoons.
A female moth will lay about 450 eggs.

MODE OF GATHERING LEAVES.

Count Dandolo states that much depends, in regard to a long preservation of Mulberry *trees* and *hedges*, on the method of gathering their leaves; that it should be done with the greatest care, to prevent the trees from receiving injuries. That caution is so much the more necessary, as nature has not intended they should be stripped

*The general computation is that an ounce of eggs will hatch 20,000 worms.

†Count Dandolo says 37 lbs. will answer.

‡The Precise number depends upon the quality of the cocoons—24,000, 2,500, 2,542 and 3,000, have respectively made a lb. of silk.

violently of their foliage. It is, says he, essential that all the leaves should be pulled off, for if any remain on some branches, they attract the sap whilst the naked branches are incompletely nourished. The stripping of the leaves should not be begun before the disappearance of the dew, and ought to be concluded before the setting of the sun. The hand should move from below upwards, in order to avoid pulling off the buds.

All climbing upon trees must be avoided, and the best way to gather the leaves, it is suggested, would be to use a rolling ladder, which consists of two parts, a wheelbarrow, the legs of which are to be from seven to eight feet long, straight, somewhat projecting beyond the wheel, and connected by four cross sticks; and a ladder six feet long, which is attached to the wheelbarrow by a fourth cross stick; with this apparatus a single man is able to carry several bags of leaves. The end to be placed on the ground must be pointed with iron. The bags used in this apparatus must be hooped, so as to remain open, and ought to have a hook to be hung on the branches, and care must be taken that the leaves be not emptied on the ground, it being particularly desirable to keep them clear of dust: when conveyed to the wheelbarrow they should be kept sheltered from the sun. Leaves covered with a tough viscous matter,—the honey dew, as it is called,—are injurious to the worms; they must be used only in case of necessity, and not then until they are thoroughly washed and dried.

If the *hedge-form* be adopted, *as it should be*, all the trouble and expense of the rolling ladders, will be rendered wholly unnecessary. But even in that event, lightly constructed wheelbarrows, with deep beds, might very advantageously be substituted for the cart, as a means of transporting the leaves from the Mulberry groves to the laboratory.

SUPPLY OF LEAVES.

Care must always be taken to keep a good supply of leaves pulled and stored away in some cool place, and therefore it is particularly desirable to have a spacious airy cellar under the laboratory, where you may deposit three or four days supply of leaves, so as to be prepared against rainy-spells, as it *will not do to feed the worms with wet leaves*. A brick or stone pavement would be best.—Should it so turn out, from long continued rains, that your supply of dry leaves are exhausted, you *must dry* those which you may gather wet, before you attempt to feed the worms with them. This can be done by putting the leaves on clean cloths on the floor and turning them repeatedly, so as to let the water escape by evaporation and otherwise. But such an occurrence may be always avoided by a judicious exercise of judgment, and vigilant watching of the signs of the weather, by prudently having a supply in store. Dusty leaves must not be fed to the worms.

TIME WHEN THE LEAVES ARE FIT FOR FEEDING.

It is important that the silk culturist should know when the leaves will be fit for feeding, in order that he may make the hatching of the eggs of his silk worms to correspond therewith. We will, therefore, remark that generally, the leaves of both the *Morus Multicaulis* and the *Morus Alba* would be sufficiently forward to be pulled in *Maryland* about the middle of May, to the *westward* a few days later, to the *eastward* two weeks later; and in *Virginia* (Eastern,) and the states further south, from 15 to 25 days earlier.

THE LABORATORY OR COCOONERY, &c.

Having thus fully spoken of the Mulberry tree, and given all the necessary instructions relative to its culture, from the sowing of the seed, until the trees are sufficiently matured to justify the stripping of the foliage for feeding the worms, it would seem proper that we should say something about the construction of a *laboratory*, or *cocoonery*, for the accommodation of the worms, and of the necessary fixtures for conveniently carrying on their feeding, the preservation of their health and the profitable employment of their very notable and interesting labors.

DESCRIPTION OF COUNT DANDOLO'S LABORATORY.

My laboratory, says Count Dandolo, is constructed to contain twenty ounces of the eggs of silk worms, or to accommodate 800,000 worms. It is 30 feet wide, 77 feet long, 12 feet high in the clear, and when reckoned to the top of the roof, 21 feet high. There are six rows of tables or wicker trays, about 2 feet 6 inches in width each, placed two and two, with four passages between them, each three feet wide. Posts are driven in between the trays, and strips of wood fastened to the posts horizontally, to support the trays, between which there is a space of five inches and a half to allow the air to pass freely.

There are 18 unglazed windows with Venetian shutters, outside, and paper window frames inside; under each window, near the floor, are ventilators, or square apertures of about 18 inches that they may be closed by a neatly filled sliding pannel, so as to permit the air to circulate and blow over the floor. When the air is not required, the paper frames may be closed. The Venetian shutters may be opened or shut at will, [or substituted for the common pannel shutter.] When the air is still, and the temperature of the interior and exterior is nearly equal, all the window frames may be opened and the shutters must be closed.

There are eight ventilators in two lines in the floor and ceiling, placed perpendicularly, opposite to one another, in the centre of the passages between the hurdles or trays. They have sliding pannels made of thick glass to close them, and to admit light from above. As the air of the floor ventilators ascends, and that of the ceiling

ventilators descends, it must pass through the trays. There are also six other ventilators, made in the floor, to communicate with the rooms beneath. Three of the thirteen windows are at the end of the house; and at the opposite end, are three doors, constructed so as to admit more or less air as may be necessary. These doors open into another hall, 36 feet long and 30 feet wide, which forms a continuation of the large laboratory, and contains trays sufficiently raised to facilitate the care of the worms. In this hall there are 6 windows and 6 ventilators under them, nearly on a level with the floor, and also four ventilators in the ceiling. There are 6 fire-places in the great laboratory, one in each angle, and one on each side of the centre, and a large stove in the middle; glass oil burners, that give no smoke, are used to give light at night. Between the hall and the great laboratory, there is a small room having two large doors, the one communicating with the laboratory, the other with the hall. In the centre of the floor there is a large square opening, which communicates with the lower part of the building. This is closed with a wooden folding door; this aperture is used for throwing down the litter and rubbish of the laboratory, and for admitting Mulberry leaves, which can be drawn up by a hand-pulley. Such is the construction of the laboratory of Count Dandolo.

In giving the above minute description of Count Dandolo's laboratory, we do not offer it as a *model* worthy of being adopted by culturists in the U. States. On the contrary, we think it especially to be avoided as an *example*, and for the simple reason that it is *too costly*; but notwithstanding, that we admonish against its adoption, we think valuable hints may be derived from it, inasmuch as it will enable those about to engage in the business to see the great principles to be aimed at in the construction of an establishment, to wit, "convenience, the preservation of a proper temperature, and the free circulation of air." These are the great cardinal points to which the American cultivator must attend, whatever may be the extent of the building he may construct.

Almost every large estate in the United States have buildings upon them which might at a trifling expense be converted into laboratories for the accommodation of the worms. Barns, tobacco houses, out houses, may all be so altered as to answer without at all interfering with their usefulness for the objects for which they were originally built. All buildings may be said to be proper for receiving silk worms, which have one or more fire-places, two or more ventilators in the ceiling, on a level with the floor, and windows through which light may be admitted to the exclusion of sunshine.

And where no such buildings already exist, that can be spared for the purposes of the worms, one at a very moderate cost may be erected Any one with ordinary enterprise and ingenuity may go into his woods and in a few days prepare posts, scantling and clap-boards in sufficient quantities to construct a house even upon the most extensive scale. As to the chimneys and shutters, they will answer every valuable purpose, no matter how plain, or how coarse, the materials of which they may be made.

In this country it is recommended that houses erected expressly for the purpose of raising silk worms, should be placed in the coolest places, and most airy situations attainable, and in the shade of trees, if possible, because it is always within our power to increase the heat of the apartment, when necessary, by means of stoves or fire-places, but it is not so easy to guard against a sudden increase of heat in the weather, which might go far to defeat the labors of the season, if it should occur in the fifth age, when the worms are nearly done eating, as will be seen hereafter.

We will now describe the apparatus of the reverend Mr. *Sevagne*, which is highly spoken of in the *Transactions of the Society of Arts, London.* It is recommended on account of the small space occupied by it, the neatness in which it enables persons using it, to keep the apartment clean, and the ease with which the caterpillars can be fed and their litter removed.

MR. SEVAGNE'S APPARATUS.

"The apparatus consists of a wooden frame, four feet two inches high, each side sixteen inches and a half wide, divided into eight partitions, by small pieces of wood, which form grooves, in which the slides run, and are thus easily thrust in or drawn out of the frame. The upper slide is of paper only, and designed to receive the worms as soon as hatched; the two next are of catgut, the threads about one-tenth of an inch distant from one another; these are for the insects, when a little advanced in size; the four lower ones are of a wicker work, the openings through which the dung is to fall, being about a quarter of an inch square. Under each of these, as well as under those of catgut, are slides of paper, to prevent the dung of the cocoons from falling on those feeding below."

"Mr. Sevagne afterwards found that netting may be substituted with advantage, in the room of wicker bottoms. The meshes of the netting were about half an inch square."

"The caterpillars are to be kept in the second and third drawers, until their dung and litter do not readily fall through, and then to be removed to the drawers with wicker bottoms, and fed thereon, till they shew symptoms of being about to spin. Each wicker drawer will afford sufficient room for five hundred worms, when grown to their full size."

In order to provide against a contingent increase of caterpillars, it will be always best to

have a number of *spare drawers* ready for their accommodation.

"The feeding frames of the Messrs. *Terhoeven*, of Philadelphia county, are four feet square, and are fixed to upright posts; they have two sets in one room, with passages between and around them. This size enables a person to reach any point of them. Over the shelves, are frames or shelves placed on cleets, and filled with split rattans at proper distances to permit the litter from falling through."

It is obvious to us that all costly expenditures, either in the construction of a *laboratory* or in that of the *shelves* for feeding the worms on, are not only unnecessary, but would be a wanton waste of means and time. The great object of an American culturist should, and doubtless, will be, to make money—to study utility instead of ornament—profit instead of display,—in a word, the healthful accommodation and profitable employment of his worms. If these be his objects, they can all be attained for a very small comparative amount, and if they be not, he had better not engage in the business, but leave it to the possession of those who will enter into it with a view of benefitting themselves and their country.

To those who shall be thus influenced, there can be no difficulty either in providing a house or the necessary fixtures; for they may be both provided with the least possible expense: the plainer and more simple the better. The fact is, there is a mystery thrown around these matters, as there are around every thing else in European works, calculated, if not so intended, to create difficulties where none exist, and to give to very simple operations the air of complication. We will not say that these things are done with a view of repressing the spirit of competition—of preventing rivalry—for we have alike too much respect for ourself and charity for others, to believe in the existence of motives so unworthy, unless upon the most indisputable authority; but the effect of the elementary treatises of European origin, upon this, and many other branches of industry, are so mixed up with unprofitable philosophical speculations, so embarrassed with impracticable theories, and the ostentatious display of learning, as to deter a plain common sense man from engaging in them. Whereas, when they come to be stripped of the verbiage, and to be divested of the fustian, with which they are decorated, they are very plain concerns—just such as an ordinary, enterprising, industrious farmer, might lay hold of, with decided advantage to himself, his family, and the nation at large.

Why need there be such parade about building a house for the worms to perform their labors in? In their native state, the forests of India were their dwellings, and the canopy of heaven their only cocoonery, or laboratory. There, there were no venetian shutters, no costly wicker or latticed work shelves, no hygrometers nor hydrometers, and yet they lived on mid sunshine and rain and thunder and lightning. True they were then in their wild and native state—true also it is, experience has shown that since domesticated by man, and furnished with dwellings, they have yielded more and better silk; have suffered less from their natural enemies: but then, we maintain, the more simple and plain their accommodations are, the better. In proof of this, we would mention that in Italy, France, Bavaria, and other European countries, where the silk culture forms a material branch of husbandry, the hovel of the peasant, the barns, kitchens and all other out-buildings of the opulent, are each converted into *laboratories* for the time being. And such also, is the fact in the New England states. There, those who have not the means of constructing *cocooneries*, as they there term the feeding houses of the worms, give them, during the short period of their labors, situations in their dwellings, barns and every other place on their respective farms, calculated to afford room and shelter. In corroboration of what we have just said, we will quote from Mr. Cobb's excellent Manual, the observations which he makes upon this head. He says:

"European laboratories have been constructed with great care and expense; but however convenient these may be, they are by no means necessary to success in rearing silk worms; almost any building will answer for that purpose. I have reared them myself with success in a *barn*, in my *cellar*, *kitchen*, and other rooms of my dwelling-house, and in the *lower story* of *Tremont* House, in Boston."

It was found in France that the cocoons brought to market by the peasants, raised in hovels so full of cracks as easily to be seen through, and to admit the air freely, were richer and heavier than those raised in palaces and in the confined rooms of dwellings in cities.

We infer from all that we have seen and read upon the subject, that all to be aimed at in the erection of a laboratory, is, to put up a plain, cheap, substantial house, sufficiently large to accommodate the number of worms you contemplate feeding; to be provided with windows that will *admit* the *air* and *exclude* the *sun*; with fire-places or stoves, as may be most convenient, so that a proper temperature may be kept up at all times, and especially when it rains, as dampness exercises a pernicious influence over the worms, in generating a noxious effluvium, detrimental to their health.

Upon the subject of a laboratory or cocoonery, and the necessary fixtures, we shall further copy from the excellent essays of our intelligent townsman, *Gideon B. Smith*, Esquire, whose experience and observation entitle his opinions to every possible consideration.

MR. SMITH'S PLAN.

"The *fixtures* necessary for raising silk worms are, appropriate tables or shelves, in number and size corresponding with the number of worms to be fed. The best form for shelves that I have seen is that adopted by my friend, Mr. J. Y. Tompkins, of this city. It is about 2½ feet wide by 5 or 6 feet long, made of thin boards, with a piece 2 inches wide nailed flat on the upper edge along the sides and ends, with legs about a foot long in the corners. The legs do not pass through the table, but leave a part of the hole on the upper side, for the feet of another table to set in. Thus contrived, five or six of these tables are set one above another, and are taken down, cleaned, and again set up with facility. One of these shelves will accommodate about 500 worms. If I could suggest any improvement in these shelves, it would be the substitution of twine net-work for the board of floors, with slides under them to catch the excrement of the worms.*

The room or laboratory must, of course, be of a size proportionate to the number of worms raised, and should be provided with windows or ventilators on the north and south sides at least; and if one or two ventilators, are opened in the ceiling it will be of great service. These ventilators, however, should have shutters that they may be closed at any time when necessary. Fireplaces or stoves should also be provided for use when necessary. For the accommodation of 1,000,000 worms, a room about 80 feet long and 40 wide would be required. A large establishment would also require a ware-room for the deposit of leaves, and this should be large, so that in wet weather the leaves may be shaken and scattered about for drying. This room might be advantageously situated above the laboratory. A cool, dark cellar, will also be useful, for keeping the leaves fresh in dry weather:—White Mulberry leaves will thus keep fresh for three days—the native Mulberry will not keep so long."

NUMBER OF ATTENDANTS NECESSARY FOR A MILLION OF WORMS.

Mr. Smith says that,

"The number of attendants necessary for 1,000,000 worms will be *two* the *first* week, *four* the *second*, *eight* the *third*, and *sixteen* to twenty the remainder of the feeding season; one half of which may be boys and girls."

In speaking of his fixtures, Mr. *Cobb* of Massachusetts, says:

"I have used three tiers of rough pine boards fixed upon upright posts, about 4 feet in width, one above the other, with a space between, of two and a half feet, affording sufficient room to pass all around the frame, so that I could conveniently reach any part of it."

The plan of Mr. *Cobb*, the reader will observe, is that pursued by Messrs. *Terhoeven*, of Philadelphia county, Pennsylvania, and does not differ at all from that recommended by Mr. Smith.

On the subject of a laboratory and its fixtures, we will give one other plan, which we copy from the Northampton Courier. It is that of Mr. *Whitmarsh*, which, as we have before remarked, is indebted to Mr. Smith for, probably, the best part of its arrangement; we allude to the lattice work frames, which are identical with those of the Rev. Mr. Swayne.

MR. WHITMARSH'S COCOONERY.

"Mr. Samuel Whitmarsh is erecting an edifice of two hundred feet in length, east of his house on Fort Hill, as a Silk House and Cocoonery. The plan of it is original, and promises the best results. The worms while feeding, are now laid out upon boards and benches by those who rear them, covered with Mulberry leaves, and when for health and cleanliness they are required to be moved, it must be done separately.

Mr. Whitmarsh's building is intersected by alleys, and on each side tiers of sliding frames or drawers rise from the floor upwards. These frames are covered with *lattice work of twine*. The top one is laid over with leaves upon which the worms feed. The second frame about an inch and a half below, is covered with strong paper or coarse cotton. The stems of the leaves or offal from the worms fall from the lattice work, above upon this drawer, and when the usual time for cleaning them comes, instead of lifting each separately, it is only requisite to remove the lower drawer and the cleaning is accomplished.

The leaf of the Chinese Mulberry, which Mr. W. will use, is so tender that the worm will devour it all. Sometimes they will fall from the lattice work above upon the paper drawer below. In that case, when a supply of leaves is laid on above, the worms at once ascend, as the distance is not too great between them, to prevent their reaching above. This is a great and important change introduced into the method of feeding and cleanliness, saving time and promoting the health of the worms.

Another improvement to be introduced by Mr. Whitmarsh, is the aid given the worms in winding their cocoons. Now, when the worms have terminated their feeding, easily known by their movements, branches of trees and bushes are laid over or suspended above them, and among which the process of winding is carried on. Consequently, they are much entangled in securing themselves, and lost to sight, and a great deal of labour and silk is lost, in the awkward method of separating the cocoons for use, from the bushes.

*This hint has been improved upon by Mr. Whitmarsh, as the reader will see in reading the description of his "cocoonery."

He proposes, when the worms are ready to wind, to transfer them to upright frames, with twine lattice work, standing about an inch and half apart. The worms will reach over from one frame to the other, fasten themselves at each extremity, and then, in a small compass, envelope themselves in their cocoons. Every thing is then clean and compact, and after they have finished winding, the frames in pairs can be put away compactly, and, when wanted for use, the cocoons may be easily taken off. The building is well contrived for ventilation, and the reeling, by steam power, will be carried on in the same edifice. He intends to feed a million of worms this summer and reel four or five hundred pounds of silk."

We have been thus particular in developing the various plans of laboratories and fixtures, because it is the only part of the silk and Mulberry culture which can, in the least, be thought to bear the smallest resemblance to costliness, and the intelligent reader will find on a proper examination, that for a very few hundred dollars a house calculated to accommodate many millions of worms may be built, and that it is so simple in its construction as to be within the achievement of the mechanical skill of most plantation hands.

HATCHING THE WORMS.

The time of hatching the eggs is to be determined by the forwardness of the season, and should mainly be regulated by the state of the Mulberry leaves on which they are to be fed and supported; for it is a reckless waste of time and hazarding of prospective gain, to bring them into being before you are prepared to sustain their wants. All the authors we have consulted agree in this, that as soon as the leaves have developed themselves you may make your arrangements for stimulating the worms into life. Upon this head Mr. Smith observes that:

"At the period for hatching, which in Maryland, is generally about the 1st of May, the eggs which are presumed to have been kept in the cellar, may be brought out and spread on paper on a common table, called the hatching table. The proper period is always best ascertained by the state of the Mulberry leaves. I consider the best and most safe time to be that when the leaves are about the size of a half dollar. The hatching table may be kept in the common laboratory. If the weather be mild and warm, the eggs will begin to hatch in eight or ten days. The first day or two there will but few leave the eggs. They need not be attended to. On the third a considerable quantity will hatch. Some fresh leaves should then be laid on them, when they will soon attach themselves to the leaves, and should be removed on to a shelf and be thinly spread out. The next day all that have hatched should be treated in the same way; and so on till they have all hatched, which will generally be in five or six days. Each day's hatching should be placed on separate shelves, and the whole laboratory arranged into as many divisions of shelves as there were day's hatchings, that they may be continually kept separate. This is important that the periods of moulting and spinning may be as nearly the same with all the worms on a shelf as possible.

In large establishments a small close room, with a stove will be very useful in hatching the eggs, as the temperature may be regulated at pleasure. But in this case a thermometer is almost indispensable, as there would be danger of too high a degree of heat, which would spoil the eggs at this season, and the necessary equability and gradual increase of the temperature could not be secured without one. In this mode of hatching by artificial heat, the worms will be brought out with more regularity and in less time than in that above described, and therefore it is preferable in large establishments. The hatching room should be, when the eggs are carried into it, of about 70° temperature, which should be increased one degree a day till the worms are hatched. The hatching room will therefore be of about 80° temperature when the worms are hatched, and if the laboratory is not then about the same temperature it should be raised to it, or nearly so, before carrying in the young worms, that they may not experience too great and sudden a change The leaves may be torn in small pieces whilst the worms are small, and the worms should be fed during the first week two or three times a day, by scattering the leaves over them. The second week the worms will require food three times a day, the third, fourth and fifth, it should be given them as fast as it is either consumed or becomes withered."

Having thus copied the plain common sense directions above, we would respectfully state that Count *Dandolo*,—and those who have either *abstracted* or *transcribed* his plan, for most all the writers appear to have done either the one or the other,—recommends that,

"When the Mulberry leaves are about to open, the cloths upon which the eggs are fastened, should be put into a small pail of water, steeped up and down, that they may be thoroughly soaked for nearly six minutes, which will be sufficient to dissolve the gummy substance by which the eggs are stuck to the cloth. The six minutes elapsed, the cloths must be taken out, and the water allowed to drip from them, by holding them up for two or three minutes. They should then be spread upon the table, the cloth to be well stretched, while the eggs are separated from the cloth with a scraper. The scraper should not be too sharp, for fear of cutting the eggs, neither too blunt, lest it should crush them." And after the eggs are off the linen cloths, they are to be put into a basin and submit-

led to the operation of another washing, and then drained either by means of a sieve or cloth and dried, &c.

We have given this not with a view of recommending it, but merely of showing the parade that is thrown around a few eggs by giving a factitious importance to what does not deserve a second thought. Where we would ask did the worms in their native state procure their *scrapers* and persons to use them? Where did they derive the water to perform their ablutions in? Where let us ask, has science derived the knowledge of the fact, that the gummy substance, which gives to the eggs their cohesive property, should be removed? We are not among those who would reject all improvements upon *nature*, but we confess we are of those who believe that all improvements tending to domesticate such interesting and ingenious *artistes* as are the silk worms, should approach as near their mode of operation in their untamed condition as possible.

It may possibly be asked, as we have set our face against innovations, where in their native forests, did the silk worm obtain a thermometer? —By what process did he regulate the temperature of the atmosphere? We answer that he did not obtain a thermometer any where; nor did he find means to regulate the temperature of the atmosphere. But these facts do not in the least militate against the soundness of our position, as from the difference in the climate of that country and ours, what would be wholly superfluous there, would be absolutely requisite here. There, the equality of the temperature of the atmosphere, renders such an instrument entirely unnecessary—here from the ever changing character of our climate, from hot to cold, from dry to humid, it is essentially necessary to the preservation of their health and the successful prosecution of their labors in all large establishments. The use of fire in stoves or fire-places are for the two fold purpose of maintaining a temperature ranging from 70 to 80 during the period of hatching the eggs, and from 65 to 70, afterwards, up to the completion of their toils, and to preserve the atmosphere *dry*. We do not pretend to affirm that worms cannot be successfully hatched and raised without the aid of either stove, fire-place, or thermometer: on the contrary, we know that in the Eastern states they have been so raised, and are continued to be, by probably a majority of the farmers; but we think we are justified in the opinion that to ensure success, as we have before premised, to any *large establishment*, the culturist should be able to create an artificial temperature at all times, so as to counteract the deleterious influence of sudden atmospheric transitions, whether from heat to cold or from aridity to dampness.

In maintaining this opinion we but consult nature, in the promotion of the health and comfort of this most ingenious insect, and consequently, ensure a vigorous prosecution of his labors. It is affirmed by every writer that a certain temperature is necessary to be preserved during the period of incubation, and if that be necessary, it can only be successfully done in *extensive laboratories* by means of the instrument named. But there is also another important object to be gained. It is known, that, where large bodies are brought together in the same apartment, an atmosphere is generated, which if not corrected will prove detrimental to their healthful existence, and it is a fact equally well known, that there is no more efficient purifying agent than fire. The silk worm when congregated together in large masses make, comparatively, great deposites of noxious substances, which, no matter how much cleanliness may be observed, will become fetid and fill the apartment with vapors of an offensive and injurious character. It is also important to expel dampness whenever generated, and this can only be done by *heat;* but then as the degree of heat must not be pushed beyond the prescribed point, an instrument is necessary to designate that *point*. In small establishments, the objects pointed out can be attained without the agency of any such instrument, as for instance, the farmer who appropriates but an acre or two to the culture, would be able to get along without it, making his feelings and judgment the criteria with respect to the temperature. In speaking of the necessity of preserving a *dry* atmosphere, we do not wish to be understood as pushing it to that point of rarification that would be offensive to a human being; *that* is to be equally avoided, and hence when inconvenience may arise from that cause, the introduction into the room of a few bowls of water, as is now practiced in ordinary stove rooms, will be proper to counteract it. We deem this explanation the more necessary as our aim is to unfold, as far as we can arrive at them, the difficulties as well as the advantages of the culture, to the American people. We shall, we trust, ever be found too tenacious of our own self-respect, and, to value the good opinion our fellow men, too highly, to jeopard either the one or the other by making misrepresentations in this or any other branch of husbandry, which we believe could not be realized; nor will we through fear of deterring persons from entering into it, fail from making what we consider a candid and manly exposition of our honest and sincere convictions. Our object is not to get the agricultural community to adventure into this branch of husbandry with their eyes shut to it disadvantages—our desire is to lure them to its embrace by a candid and open statement of facts—we should scorn ourself, could we be influenced by other motives —could we be guilty of concealment. We believe that the culture is destined, if well pros-

cuted, to enrich those who may engage in it, and we feel it our duty to deal in all sincerity, truth, and fairness, in whatever we may advance upon the subject.

If the stoves be employed to produce the necessary temperature, it is thought that they should not be made of iron, because the heat cannot be regulated so accurately therein ; but of thin bricks, soapstone, porcelain, or tiles. The stoves made at Bethlehem, Pennsylvania, of the latter material, or the porcelain ones which come from France, at a price of about $10, would answer well, and in order that the heat generated should be equable, the fuel should be either *tanners' drawn bark or charcoal.*

Count *Dandolo* prescribes that the eggs be hatched in a small, square, thick pasteboard, or thin board boxes or trays. For an ounce of eggs, a box or tray eight inches square is required, and so in proportion for a greater amount, and these to be numbered. Besides these, he says, there should be wicker trays or boxes projecting horizontally from the wall for the boxes containing the eggs to be placed in for hatching, a flat spoon to stir the eggs well. This part of his plan, is, we think, multiplying fixtures and magnifying difficulties, without any possibility of increasing the product of the worms whatsoever. Simplicity in their treatment, economy in the use of means, and an approximation to nature, should be the great objects to be held in view by the American silk culturist.

With respect to the temperature of the apartment in which the worms are hatched, it may be instructive to add the observations of Count *Dandolo.* He says :

" If the temperature of the stove room should not reach 64°, on the day fixed upon to put in the eggs, it is necessary to light a little fire, that it may raise to that degree, which ought to be continued during two days. If the thermometer indicate that the exterior air is above 64°, the shutters should be closed, and the doors and ventilators opened, to create a draught and cool the stove room. The *third* day the temperature should be raised to 66°, the *fourth* day to 68°, the *fifth* day to 71°, the *sixth* day to 73°, the *seventh* day to 75°, the 8th day to 77°, the 9th day to 80°, 10th, 11th and 12th days to 81°.

The following are the signs of the speedy vivification of the silk worm :

"The ash-gray color of the eggs grow bluish ; then purplish ; it then again grows gray, with a cast of yellowish, and finally, of a dingy white."

Count *Dandolo* further remarks that:

" When the eggs assume a whitish color, the worm is already formed, and with a glass, may be seen within the shell. The eggs should then be covered with white paper well piered with holes, the paper to be cut so as to cover them all. To encourage the worms to come through the holes, small twigs of the Mulberry, with but few leaves on them must be placed on the outside of the paper, the scent of which attracts the worms: they crawl through the holes and attach themselves to the food. The number of twigs to be increased as fast as the worms occupy those on the paper, to prevent their getting out of the boxes in search of food."

" When the worms are red at their first coming out, it is a sign that the eggs have either been bad or ill kept over winter, or over heated, that is, too much forced when laid to hatch. Worms of this color are good for nothing, and should be thrown away, since they will not produce cocoons."

" Few worms appear the first day, and if the number of them should be inconsiderable, it is best to throw them away, as it is well not to mix them with later worms. If not thrown away they should be kept on separate shelves.

Eggs which have been scraped from the paper on which they were laid, should be stirred round two or three times a day. This operation hastens their coming forth."

A prudent cultivator, says Count *Dandolo,* has done all in his power, when, on observing the season favorable, and the bud of the Mulberry shoots in a proper degree of forwardness he has put his eggs into the room for hatching ; and if after they are there, or even after being hatched, a sudden change of the weather should take place, and it be desirable either to retard the hatching, or to depress the appetite of the worm, both or either can be effected by lowering the temperature of the air of the room, gradually to about 68°.

Upon this Count Dandolo remarks:

" This cooling of the air diminishes the hunger of the young silk worm by degrees, and without danger; and by these means the modifications are prevented, which at 75° would have brought on the casting or moulting much more speedily. At 75°, the moulting is effected the *sixth* day ; whilst at 71°, it requires *six* or *seven* days. The second moulting, which at 75°, is wrought in four days, at 69° and 71°, takes six days for its accomplishment. Thus by foresight and prudence, the proprietor will be enabled to gain seven or eight days, which prevents any ill effect from the unfavorableness of the season ; and this time gained, it is evident, may be of the utmost importance."

We shall now quote from the essays of *Gideon B. Smith,* Esquire, his treatment of the worms from the hatching of the insect to the completion of the cocoons. His instructions are the result of practice, backed by close observation and a sound discriminating mind. With such lights as his guide, the culturist cannot well fail to pursue the business with an enlighted economy, and to find in it a most interesting and profitable pursuit.

"The period of moulting are, generally, about the 7th, 13th, 19th and 24th days of their age, but these periods are materially influenced by the care and attention bestowed on the worms—some worms will begin to spin on the 25th day; while others will delay their spinning even to forty-five or fifty days, according as they are well or ill attended to. At the periods of moulting, the worms do not eat, and if they all moult together, no feed need be given them; but should they not be thus simultaneous in changing their skins, those which require food should be supplied, even though the others may be disturbed by it. They are about 36 hours shedding their skins.

The Italians strenuously insist upon cutting the leaves *fine*, before giving them to the worms; but, having tried this plan, I found an objection to it which induced me to reject it. When the leaves are cut fine, the worms easily press them down, and they are lost, having become a mere carpet for the worms. I therefore, never cut the leaves after the worms are two weeks old; but for several reasons, I prefer laying on the whole leaves, and even the small branches. When laid on whole, the leaves keep fresh till consumed; especially when left upon the small twigs. The small branches have another advantage—the worms can climb, and fix upon them, over and under them, so that the same shelf will accommodate many more than when the leaves are cut fine and they are obliged to remain on a common level surface. The worms also prefer this mode, as it approaches nearer to the nature of the limbs of the tree.

Every two or three days the shelves should be well cleared of litter and excrement, to effect which the worms may be removed in the following manner:—lay on either large leaves or twigs with leaves, and as soon as the worms attach themselves to them, bear them to a clean shelf; repeat the operation till all are removed. Some lay fresh leaves on one side of the shelf, and leave the worms to go over to them, and clear off the other side. I prefer the first plan. Very few leaves will suffice for the first ten days; a dozen, torn into small pieces will be enough for each shelf, the 1st, 2d, 3d and 4th days; double the quantity the next two days. However, it is unnecessary to attempt estimating the quantity, as the intelligent attendant will readily discover what is necessary, and be able at all times to guard against both stinting the worms and waste of leaves. They should always have as much as they will consume and no more. Great care must be observed that the leaves be perfectly free from wet, and fresh. When they have been kept some time, the leaves begin to turn black or dark colored, and should be thrown away. In wet weather, the leaves may be dried by taking them into a large room, spreading them out, and occasionally shaking them up.

Great care should be taken to guard against mice and ants; mice devour them with avidity, and the bite of an ant is almost instant death to the worm. Isolating the shelves from the walls and setting the feet in basins of water will protect them from ants; but the access of mice to the room must be cut off.

The success of the crop depends upon the cleanliness of the shelves, and purity of the air in the room, especially in hot, and more particularly in damp weather. If the excrement and litter be allowed to accumulate, fermentation and putrefaction soon commence, and the consequence will be fatal to the worms, especially in hot, damp weather; besides, the worms at all times thrive better when the shelves are kept clean, and nothing but fresh leaves allowed to remain about the worms. To guard against impurity of air, which is the greatest enemy the silk worm has, a small quantity of *chloride of lime* should always be kept in a plate in some part of the room. It is a cheap and most effectual preventive of this cause of disease in worms, as well as a powerful remedy for the *tripes*, and other diseases that have become epidemic. It is generally sold at the drug shops at 18¾ cents a pound, and four pounds will be sufficient for the largest laboratory. A couple of spoonfuls may be put into a plate with about a gill of water, and should be replenished every three days.

Where proper cleanliness and due attention to ventilation are observed, there is little to be dreaded from hot weather. Nevertheless, in very hot weather all the means at hand should be availed of for the reduction of the temperature of the room; for worms will thrive best in moderate temperature. But ice, or sprinkling the floor with cold water, should never be resorted to, as has been recommended; for the vapor thus produced will do more injury than the heat. When convenient, the laboratory should be shaded with high trees on the south side. An open, high piazza to shield the south front of the house from the sun's rays will also be of service. Opening the windows and doors, and the ventilators in the ceiling, will then be all that can be done to cool the room; and this should never be neglected, in hot weather. There is much more danger from cold than heat; and on the slightest appearance of a cold night, fire should be made in the fire places or stoves, and replenished as often as necessary. The temperature should be kept as equable as possible, and sudden changes guarded against. For this purpose a thermometer will be useful; but the senses of the attendant will be a sufficient substitute if care be observed. I do do not pretend to give degrees of temperature most suitable for silk worms; for although we can increase the heat, it is not easy to reduce it in a large room, when the surrounding atmosphere that supplies the air circulating in it, is of a high temperature. It may be observed here, that the cool sensa-

tion felt while sitting in a current of air, is no evidence of that air or the place we sit in being of a lower temperature than the air of a room where there is no such current. The air passing over the surface of our bodies carries off heat, and thus causes the cold sensation, while at the same time the current of air, that "feels cool," is in many degrees warmer than our bodies. But silk worms are not warm blooded animals, and of course they do not experience the same relief, having no excess of animal heat to be carried off. Although many persons have assured me that they had lost many worms by hot weather, I am constrained to think, that the heat was not the sole cause of the loss, for I have never lost a worm that I could attribute to that cause. Hot weather will undoubtedly cause the destruction of the whole of them, if the litter and excrement be left unremoved; and I always suspect some such want of attention in every instance of the destruction of worms by hot weather. Heat does not injure the worms in their natural state, nor will it in their state of domestication, if they are kept as free from filth as they are on their native trees. Keeping the shelves clean, the worms not too much crowded, the air in the room pure by the use of chloride of lime and ventilation, and feeding with fresh dry leaves, I consider the best and only preventives of any ill effects from hot weather.

Between the 25th and 35th days of the worm's age they will show signs of a disposition to spin. They will become somewhat of an amber color about the joints of the body, semi-transparent, throw out fibres of silk on the leaves, and wander about. The *brush* for the cocoons should now be provided. The best and simplest that I have been able to find is the *broom-corn*. Clear it well from seed, and cut it from the stalk close to the junction of the straws: spread out the top in imitation of a small tree, and set it on the shelf with the top pressing against the bottom of the upper shelf to hold it in its position. It may be set in rows six or eight inches apart, across the shelf, and over the top shelf an extra one may be placed for this purpose. The worms will readily find and climb these little trees and spin their cocoons in them; the worms will be four days spinning their cocoons, and they will all generally be finished on the 8th day after they first begin—that is, all of the same day's hatching. The brush may then be taken down, the cocoons taken off, cleared of the loose *tow*, and prepared for reeling.

The cocoons from which eggs are expected must be spread out in a room, secure from mice and ants, and in five to ten days the moths will come out of the cocoons, when the males and females will couple; they must then be taken by the wings in pairs without separating them, and placed upon sheets of paper disposed for their reception, where they are to remain. There is generally about an equal number of each sex. I have found the best mode for fixing the paper for the moths to lay on, as follows: stretch two pieces of strong twine across the room from wall to wall, about two feet apart, and another about a foot over the middle of these. Lay large sheets of paper (old newspapers will do) over them and pin them down at each side to the lower twine. The sheets of paper will then be in the form of the roof of a house. As many pairs of moths as can conveniently lie on the papers may be placed there. This mode has the advantage of security against ants and mice, which are very destructive to these insects. The room should be dark, if possible, while the insects are on the papers, and each sheet should be filled before any are put upon another, and as soon as the moths on one sheet are done laying eggs, it should then be taken down, folded, and put into a tin box in a cold cellar, where all the eggs must be kept till wanted for use next spring. The moths are in the form of a grayish white butterfly, and generally begin to lay eggs in 24 to 36 hours after leaving the cocoons. The eggs are at first of a pale yellow, or somewhat of a sulphur color, but in three days turn to a light slate color, and subsequently to a dull brownish slate color. When seen through a microscope they are speckled. Those that remain yellow have not been fecundated, and of course are worthless. Each healthy female moth will lay about 450 eggs, generally, handsomely disposed and firmly attached to the paper in a circular form, the whole covering a space about the size of a fifty cent piece.

Should the eggs be permitted to remain exposed to the warm weather, they will hatch, and, unless another crop be desired, they will be lost. This is the only injury they are liable to from warm weather. The flies eat nothing after leaving the cocoons, and die in a few days after depositing the eggs. The tin box in which the eggs are directed to be kept, is intended to protect them from mice and insects. The eggs should be kept in a dry cellar, as mould and mildew will injure them. There will be many double cocoons, those which have two or more worms in them; these and as many more of the others as are wanted should be selected for eggs.

After clearing the cocoons of the loose *tow*, such as are intended for reeling, and cannot be wound off immediately, must be subjected to some process by which the chrysalis will be killed, to prevent its perforating the cocoon. Heat is most commonly applied. In Europe the modes of its application are various. Some *bake* the cocoons in an oven about half heated for bread; others apply steam, and others expose them to the rays of the sun for several days during the heat of the day. There is danger of scorching the silk in the first mode; of decomposing the fibres, in the second; and, of not perfectly accomplishing the object in the third. I have found the following mode preferable to any other, as the object is perfectly effected without danger to the silk. I put the cocoons into a tight tin vessel, with a cover closely fitted; and put this vessel into another a little larger, containing such quantity of water as will nearly fill it when the other is put into it; the fire is then applied and the water kept boiling half an hour, or more, according to the size of the vessel and until the cocoons in the inner vessel shall have become as hot as the boiling water. The cocoons are then spread out in a dry room, that whatever moisture there may be, may evaporate. By this mode, the heat can never be raised so high as to injure the silk, and the fibre is not loosened by moisture; on the contrary, much of the natural moisture of the cocoon is dispersed. After this operation, the cocoons are ready for the reel or for sale. All the cocoons that can be reeled in the course of

the first week after they are taken from the bush, may be reeled without this operation; and a considerable advantage is gained by thus reeling them, as they unwind much easier than when they have been heated. Cocoons intended for sale, or keeping on hand for future reeling, must be secured against mice and roaches."

It has been our desire from the beginning to make our Manual a plain, practical treatise, which could be laid hold of by every man, woman and child who could read---in a word, which could be understood and practised by all; and after reading every thing within our reach, we have selected the above general rules for the feeding of the worms, and the reader will observe, that there is no attempt at mystery; no burying of meaning by the unnecessary multiplication of words, and to Mr. Smith's plan we have nothing to add, save the *net-work frames*, which at his suggestion Mr. Whitmarsh has adopted. By the substitution of these a great amount of labor is saved, and the means of health promoted, by increasing the facilities of cleansing the worms, and consequently, of purifying the apartment.

As to the *apportionment of food*, that must, in a great measure, be left to the discretion and judgment of the chief superintendent; for although it has been reduced to a certainty, that a *thousand worms* will, on an average, devour during the feeding season from *thirty-seven and a half to fifty pounds* of leaves; yet the quantity to be progressively fed out, must, to a considerable extent, if not altogether, be regulated by the wants and necessities of the worms for the time being. Their appetites must govern in the main. Whatever quantity of leaves they *consume cleanly*, from one feeding time to another, it is to be presumed has been advantageously eaten, and whenever it shall be found that more has been given than the worm can *consume*, the subsequent feeding must be lessened in quantity, while on the other hand, if they should, between those periods, be any considerable time without leaves, the ensuing feeding must be increased; for while it will not do to *gorge* the worm, neither will it answer to keep him without food for any length of time, as abstinence is both detrimental to his health, and injurious to the interest of his feeder.

In the eastern states, the feeding of the worms, heretofore, has been carried on with the least possible trouble, and from what we can learn, with, perhaps, too little regard to cleanliness, to be followed in large establishments, for however well such neglect may succeed upon a small scale, if you come to carry it out in a large establishment, much positive evil will ensue in the death of the worms. Small bodies might exist under a system of inattention, which if followed in an extensive laboratory, would end in the mortality of the insects, and the pecuniary loss of the proprietor.

In *Turkey*, according to Mr. *Rhind*, "the production of silk is confined to cities or the larger towns, in the vicinity of which the Mulberry tree is chiefly cultivated; those trees belong to the Farmers, or proprietors of the ground, who do not rear the worm themselves, but during the crop season, the leaves are collected by them daily and carried into the city and sold in the market in the same manner as fruit and vegetables, in such quantities as purchasers may require. At the commencement of the season almost every family clean out all the rooms in the house, except one in which they live during the crop season; the worms being produced, they purchase a quantity of leaves and strew them over the floor, leaving a small space next the wall that they may walk round and distribute the leaves; they then place the worms on the leaves, who readily attach themselves, and they daily throw on such quantities as experience teaches them will supply the want of the worms, and this they repeat until the worms are ready to rise and wind the cocoons, without ever removing the offal or straw, and frequently the pile of collected matter will reach the height of three or four feet. When the worms show symptoms of winding, they plant branches and bushes immediately over the collected mass, and the worms rise on these, the cocoons are formed and collected, and the rooms are then cleaned out and the reeling is commenced. This manipulation is performed in the most clumsy manner and with the rudest machinery imaginable, notwithstanding which, they produce the finest silk in the world."

Now this *Turkish* method of attending to the worms is simple enough in all conscience; but it is so filthy as to be repulsive to our very nature. The Turks, as every body must know, are proverbial for their love of ease, for their lazy disposition, and hence their system of feeding of worms is formed solely with the view of consulting their own idle habits; but however much we may condemn it for its want of cleanliness, we may learn important truths from its very defects and deformities. We may learn this, that the raising of silk worms is a very simple thing, unattended with any difficulty which ordinary industry and discernment may not overcome. From what we have read and seen, we deduce these facts, that nothing is wanting to ensure success to the culture—☞ *but room for the worms, a supply of food for them to eat, regularity*, and *cleanliness in their feeding, proper ventilation of their apartments, and untiring attention to their wants.*

The general rules laid down by Mr. Smith will be sufficient for most readers, but as there may be some that would prefer to see something with respect to the *quantities* of food to be progressively given, we will abstract from Count *Dandolo's* plan all that we esteem essential to be known upon this part of the business, and we will here remark, that from the great regard for exactitude of this distinguished culturist, the utmost reliance may be placed in his statements.

The quantity of food is the proportion given to the worms hatched from 5 ounces of eggs, which, according to our reading, means 100,000 worms, allowance being made for casualties of all descriptions.

REARING OF THE WORMS IN THE FIRST AGE.

First day. The worms should occupy a space of nearly 36 feet 8 inches square on the wicker trays or tables. They should this day receive 3 1-3 lbs. of leaves chopped small, dividing their meals through the 24 hours into *four*, at intervals of 6 hours each. The worms to be fed regularly four times a day, and not to give them their food all at once. Care to be taken in giving the food to widen the square by degrees.

Second day. On this day 6 lbs. will be needed. This will suffice for the *four* regular meals, the f

of which should be the least, increasing them as they proceed.

Third day. This day 12 lbs. of leaves will be neccessary.

Fourth day. This day but 6 lbs. 12 oz. of leaves must be given, as the quantity must be decreased, as the appetite diminishes: the *first meal* 2 lbs. 4oz., and the other meals to decrease in proportion as the quantity of leaves given before, appears not to have been thoroughly eaten. It is important as the worms grow rapidly now that they have plenty of room. At the beginning of this day, many of the silk worms begin shaking their heads, which indicates that they feel overloaded by their covering or skins. Some of them eat little but keep their heads erect. Towards the close of this day, the greatest number of the silk worms appear torpid and eat no more. As a general rule, it may be proper to apprise the culturist, that during the time of moulting, the worms must not be disturbed; for the process of changing their skins will be thereby interrupted.

☞ The hurdles or trays should be cleaned before and after every moulting, until the fourth age, once during that age, before and after the *fourth* or last moulting, and every two days during the *fifth* age.

Fifth day. This day 1½ pounds of leaves chopped small will be sufficient, to distribute whenever the worms appear disposed to eat.

Towards the end of this day the worms are torpid: a few begin to revive.

The *first age* of the silk worm is generally accomplished in *five* days, exclusive of the two days occupied in bringing them forth.

SECOND AGE.

Nearly 73 feet 4 inches square of the tables or trays, will be necessary for the accommodation of the worms from this period to their second moulting. The temperature should be from 73° to 75°. The insects should not be lifted from their litter until they are nearly all revived. No harm will arise from waiting, even though it should be for twenty or thirty hours from the time the first few began to revive.

First day. For this day 9 lbs. of young tender shoots, and 9 lbs. of Mulberry leaves, well picked and chopped small.

The method of reviving the worms is thus described.

When nearly all the worms are roused, and begin moving their heads, and raising up as if they sought something, those at the edge of the paper having already left the litter on which they had lain, preparation should be made to remove them, that the sheets of paper may be cleaned. The worms should be removed from those sheets of paper first when they are perceived to be most revived and stirring. Some shoots of the young twigs of the Mulberry tree, with six or eight leaves on them should be put over the silk worms; then boughs should be placed, so that, when spread out, there may be an inch or two between them. When one of the sheets of paper are thus covered with silk worms, another must be begun, and so on until all are completed. Each, as filled, are to be removed to a clean tray, sheet or hurdle.

An hour or two after the worms have been thus removed, they should be given a meal of 3 lbs. of leaves chopped small. In the remainder of this day, the worms should have in two meals, the remaining six pounds of chopped leaves, with an interval of six hours between each. The hurdles from which the silk worms were removed, will, of course be cleaned.

Second day. Thirty pounds of chopped leaves to be divided into four portions, should be given at intervals of 6 hours each; the two first meals less plentiful than the succeeding ones.

Third day. This day 33 lbs. of chopped leaves well picked will be necessary; the two first meals to be the largest. The leaves should be distributed in proportion as they may be wanted, and with attention. Towards evening some of the worms will begin to refuse to eat and rear their heads up, indicating their approaching the period of torpor.

As a general remark, it may be observed, that as the worms increase in size, the space allotted to them should be enlarged.

Fourth day. Only 9 lbs. of leaves will be necessary this day, as the worms will sink into torpor and shed their skins the ensuing day.

THIRD AGE.

On this day 15 lbs of the small shoots will be necessary and the same quantity of picked leaves---the temperature of the apartment from 71° to 73° during this age. Their removal to be the same as in the previous age---the space for their accommodation 174 square feet. The 15 lbs. of young shoots to be the first meal of the worms. When they shall have eaten the leaves upon the shoots, give them a second meal of 7½ lbs. of leaves, and the remainder to be given at an interval of six hours.

Second day. This day 90 lbs. of picked leaves chopped will be needed, the two first meals the smallest.

Third day. This day 97 lbs. of leaves are to be given, the two first the largest meals.

Fourth day. This day only about 52½ lbs. of chopped leaves will be requisite, as the appetite of the worms always decrease immediately preceding their becoming torpid. The first meal to be the largest and so on to the fourth, that being the last.

Fifth day. To-day only 27½lbs. of picked leaves must be given them. If, however, they appear not to have enough, more must be given them. They become torpid this day.

Sixth day. On this day the worms arouse from their torpor and accomplish their third age.

FOURTH AGE.

The worms during this period should occupy a space of about 412 feet square---the temperature should be from 68 to 71.

First day. On this day 37½ lbs. of young shoots and 60 lbs. of picked leaves will be needed. After the worms consume the leaves on the young shoots, they should be given 30 lbs. of leaves, and when these are consumed they should have the other 30 lbs.

Second day. 165 lbs. of leaves must be given to-day; the two first meals the lightest and the last the most copious.

Third day. 225 lbs. of leaves to day; the two first meals the most plentiful; the last meal to be about 75 lbs.

Fourth day. 255 lbs. of leaves to-day; the three first meals 75 lbs. each, the 4th the remainder.

Fifth day. No more than 128 lbs. of leaves to-day; the first meal to be the largest. The worms become torpid to-day, and therefore, the leaves should only be distributed on such of the hurdles, where the worms are perceived not to be torpid.

Sixth day. 35 lbs. of leaves are enough for to-day, to be fed to such worms as may require it.

Seventh day. The worms rouse on this day and accomplish their fourth age.

FIFTH AGE.

First day. The laboratory should uniformly have 68° to 70° of heat—and occupy a space of 917 square feet. After the fourth moulting, the leaves should consist of the full grown leaves of the old trees. The hurdles must be cleaned every two days during this age. They must have 180 lbs. of leaves, 90 lbs. the first meal, the other 90 lbs. to be divided into 2 meals at interval of 6 hours each.

Second day. Two hundred and seventy pounds of leaves to-day; the first feed 52 lbs., the other three more plentiful, the last being 97 lbs.

Third day. The worms will require 420 lbs. to-day, to be divided into four feeds; the first should be of 77 lbs. of leaves, the last feed should be the largest, and of about 120 lbs. of leaves.

Fourth day. To-day they require 540 lbs., the first feed 120 lbs. and the last 150 lbs., the other two 135 lbs. each.

Fifth day. 810 lbs of picked leaves to be given the worms this day. The first feed 150 lbs., the last 210 lbs., and besides the regular four meals, should the worms devour their apportionment in less than an hour and a half, they should receive some leaves in the intermediate time, and should they appear to require more food than the designated quantity, they must have it, as it is important to give them whatever they will eat with avidity.

Sixth day. The worms must have 975 lbs. of picked leaves to-day, to be divided into *five* feeds; the last of which should be the most plentiful. If the worms feed voraciously at this period, and it is difficult to limit the amount, the culturist will, if it appears to him necessary, give an extra or intermediate feed.

Seventh day. The worms will require 900 lbs. of leaves this day; the first meal should be the largest, and those following should be diminished; and should intermediate meals be required, they must be given, as it will not do to let the worms suffer now. They this day attain their largest size and greatest weight.

Eighth day. This day 660 lbs. of leaves must be given in four meals; the first of which to consist of 210 lbs. of leaves.

Ninth day. 495 lbs. of leaves to be distributed to-day, as it may be wanted.

Tenth day. Two hundred and forty pounds of leaves to be given to-day as may be required. The hours of feeding, however, to be left altogether to the discretion of the culturist, as it is impossible to anticipate the peculiar necessities of the worms this day; and it is equally difficult to ascertain whether some of the worms may not require feeding the ensuing day.

This last day they attain perfection, which may be ascertained by the following indications:

1st. When, on putting some leaves on the wickers, the insects get upon the leaves without eating them, and rear their heads as if in search for something else.

2d. When on looking at them horizontally, the light shines through them, and they appear of a whitish yellow, transparent color.

3d. When numbers of the worms which were fastened to the inside of the edges, and straightened, now get upon the edges, and move slowly along, instinct teaching them to seek change of place.

4th. When numbers of worms leave the centre of the wickers, and try to reach the edges, and crawl upon them.

5th. When their skins become wrinkled about the neck, and their bodies have more softness to the touch than heretofore, and feel like soft dough.

6th. When their rings draw in, and their greenish color changes to a deep golden hue.

7th. When in taking a silk worm in the hand, and looking through it, the whole body has assumed the transparency of a ripe yellow plum. When these signs appear in any of the insects, every thing should be prepared for their rising, that those worms which are ready to rise, may not lose their strength and silk in seeking for the support they require.

GENERAL OBSERVATIONS AND RULES.

The reader will have perceived that to each day of the feeding season, a given quantity of leaves has been allotted by the diary above. This quantity in general will, doubtless, prove correct; but then the judicious, observing culturist, must not rely on these prescriptive allowances, but exercise his own judgment from day to day, with respect both to the quantity of leaves to be given, and the time when, the worms should be fed. Circumstances over which he can have no control, may operate to make the appetites of the worms keener at one time than at another; this will be indicated by the avidity with which they will consume their food. Whenever the culturist discovers that the worms have eaten all the leaves given them, sooner than usual, he must give them an additional supply to stay their appetites till their regular hour of feeding, as it is injurious to let them remain for a long time without nutrition.

The culturist will also regulate the space occupied by the worms on the feeding shelves, as they may grow in size, it being a desirable object always to give them ample room. As we have before urged upon his consideration, he will at all times take care to have the apartment, of a *large* establishment, of the proper temperature, as much depends upon it for the success of the labors of his worms; a sudden transition from heat to cold, as well as dampness, injuriously affect them.

While care must be taken not to let the worms remain too long without food, over feeding must be equally guarded against. This being the case, the sensible culturist will at once perceive the necessity for bringing his own powers of discrimination and observation into play, and that, therefore, all that the teacher can do is to give *general rules*, leaving their application and modification with the culturist. It may be laid down as an unerring principle, that the more leaves the worms consume with avidity, and in a healthful condition, the more silk will they yield. Count *Dandolo* recommends chopping of the leaves throughout the whole period of feeding; Mr. *Smith*, however, and other American f

ers, think it wholly unnecessary after the two first weeks.

During the time of moulting or changing of their skins, the worms must not be disturbed.

The hurdles, or shelves on which the worms are fed, should be cleaned before and after every moulting, until the fourth age, and then, as we have before urged, once during that age, before, and after, the fourth or last moulting, and every two days during the fifth age.

The worms of different ages should be fed on shelves by themselves, as those of unequal ages and inequality of sizes, do not thrive so well when promiscuously fed together.

Care must be observed in picking the leaves for the worms during their two first ages, such as picking off the twigs and stalks of the leaves, and to clean them of all hard and useless parts.

As a general rule it may be proper to remark, that the chief superintendent will always be able to ascertain whether a healthful atmosphere be prevailing in the apartment, by the fact, that if it be so, he will be able to breathe as freely in the laboratory as in the open air, and feel no other difference than what may arise from the heat in the interior apartment. When any difficulty of breathing exists, it should be remedied, and may be easily done by the admission of fresh air from without, and by burning some straw or shavings in the apartment. The burning of shavings, in all cases where the air of the room is damp, is recommended, as from the briskness of the fire, it much sooner distributes its heat through the apartment, and thus corrects the humid condition of the atmosphere.

The culturist will not omit to keep plates of chloride of lime, say three or four, distributed through the apartment, as it is, possibly, one of the best correctors of impure air within the power of science to apply, and therefore eminently promotive of health.

While the sun is pouring its rays upon the windows of the laboratory, the shutters should be closed, the ventilators of the apartment kept open. The windows also, to be kept open from evening till sunrise, unless the weather should be very damp or wet.

PREPARATION FOR FORMING THE COCOON HEDGE, &c.

With respect to the accommodation of the worms with conveniences for spinning their cocoons, we would barely refer the reader to Mr. Smith's plan, to be found in page 46, with these additional remarks: that should the culturist adopt the net work frame, for the purpose, brush-wood of all kinds will be superfluous. In Europe bundles of twigs of chesnut, hickory, oak or of birch, such as brooms are made of, are used. As soon as it is observed that the worms want to rise, the faggots or brush-wood should be put against the inside wall above the trays, of the most convenient size,—leaving fifteen inches between each bundle or faggot. The twigs or top branches of the bundles should touch the lower part of the tray above that on which it is placed, and by being bent down by the tray above, form a species of arch, to be given such an angle or inclination as not to be too sharp to prevent the worms from retaining their position firmly with ease. The branches should be spread out somewhat like fans, so as to permit the air to penetrate freely. Before the worms mount for spinning their cocoons, the hurdles or trays should be well cleansed, and the litter removed out of the laboratory. The cabins or arches formed as above directed should be about two feet from one to the other. When the cabins or arches are nearly laden, should there remain any silk worms on the trays, shelves or hurdles, a small branch may be put against them, and thus prevent their lying too thick together.

Two things are particularly to be attended to: the first is, to put those worms near the cabins or arches, which are perceived to be ready to rise; and the second is, to give a few leaves to those worms that are still inclined to eat. It will, therefore, be necessary in a large establishment to place this part of the business in charge of a careful person or two, as long as the worms feel a disposition to eat; if but a mouthful, they should be indulged. It often happens that after the great majority of the worms have risen, that a portion will remain on the hurdles without manifesting any disposition either to eat or rise, appearing motionless. These should be removed to a clear, dry place, where they may enjoy a temperature of 73°, and have fresh leaves distributed over them, when they will speedily revive and descend and weave their cocoons. If they should need it, bandages of straw might be placed through the branches to act as couches or supports to the more feeble worms.

As soon as the worms have all risen, the hurdles must be cleansed without delay.

When the worms manifest a disposition to rise, the temperature of the laboratory should be carefully maintained between 68° and 71°, as any violent agitation of the air, or sudden change at this particular period is detrimental to the worms. Care also should be taken to keep the air *dry;* and the chloride solution well kept up. Worms which may fall after having risen, should be placed in another situation among the more feeble ones. All diseased and dead worms should be removed immediately, and all offal should be also removed, as nothing tends more readily than a vitiated atmosphere to occasion a fermentation of the dirt and leaves. The due observance of *cleanliness*, purification of the room, and equable circulation of air, contribute no less towards the health of the worms, than to the profit of the culturist. A too dry, or too warm atmosphere, are both to be avoided, as the tendency of each is to dry up the worms and produce contraction of the skins.

It may not be amiss here, to emphatically state,—the worms must have sufficient room to perform their labors in; they must be regularly fed, kept clean, and the air of their apartment preserved alike from excess of cold or heat, or from too much aridity or dampness—in a word, cleanliness and comfort must be consulted, and when these shall have been attended to, the whole mystery of profitably feeding worms, will have been not only fully comprehended, but mastered.

VARIOUS STAGES AND APPEARANCES OF THE WORMS.

Towards the end of the 5th day the worms are torpid: a few will begin to revive.

After the first moulting, the silk worm is of a dark ash color and shows motion; the rings that compose its body stretch and shrink more freely than before.

The worms when first hatched take 56,626 to make an ounce; after the first moulting 3,840 are sufficient to make up that weight; thus in six days the worm increases fourteen times its own weight: at first it is but the twelfth of an inch long. On the eighth day it becomes torpid.

On the 9th day, the worm becomes of a light gray, the hair hardly to be perceived by the naked eye, and becomes shorter; the muzzle, which, in the first age, was very black, hard and scaly, becomes immediately upon moulting white and soft; but afterwards, again grows shining and black as before. As the insect grows older, at each moulting, its muzzle hardens; because it needs to saw and bite larger and older leaves. Its size is increased to half an inch, and part become roused on this day and part on the 10th. On the 14th day they go into torpor again; just preceding this state, the insect seeks free space to slumber in, rearing its head upwards. When on the point of sinking into torpor, they completely void all excrementitious matter, and there remains in their intestinal tube a yellow lymph alone. When the worms prepare for the 3d and 4th moulting, the ventilators must be opened.

On the 15th day, the worms begin to rouse, and thus accomplish the third age. The head and body are much enlarged since the casting of the skin.

On the 20th day, the worms become torpid: rouse on the 22d day. After this moulting, they are of a darker color, grayish with a red cast, but continue to whiten.

By the 30th day of their being fed, the worms begin to advance towards maturity, which may be perceived by their yellow color, which increases from ring to ring. Their backs begin to shine, and the rings lose their dark green color. The advance to maturity is also evinced by diminution of bulk, and by their seeking to fix themselves on the edge of the shelves or hurdles, to void the substances with which they are loaded. When these signs are apparent, the offal and excrement must be cleaned off and removed, light fires raised, and the apartment fumigated.

On the 30th day, the yellow hue of the silk worms grows deeper, their backs shine more, and in some, the rings assume a golden appearance, the muzzle becomes a brighter red.

On the 32d day, they generally attain perfection, which may be known by the following indications:

1. When on putting leaves on the shelves the worms get on them without eating them.

2. They appear of a whitish yellow, transparent color.

3. The worms get upon the edges and move slowly along, instinct urging them to seek a change of place.

4. Their rings draw in, and their greenish color becomes a deep golden hue.

Their skins become wrinkled about the neck, and their bodies have more softness to the touch than heretofore, and feel like soft dough.

6. In looking through the worm, the whole body, it will be seen, has assumed the transparency of a ripe yellow plum.

When these signs are manifest, it is time for them to mount.

VARIOUS QUALITIES OF COCOONS.

Dandolo says the cocoons may be divided into two general heads or classes; the *white* and the yellow. In the yellow we meet with all the shades from a bright yellow, diminishing, at last, to white: some few are a pale green.

There are he says *nine* different qualities, which he thus describes:

1. The *good* cocoons are those which are brought to perfection and are strong, hard, of a fine grain, and but little or not at all spotted.

2. The *pointed* cocoons are those of which one of the extremities rises up in a point, and are difficult to reel, because when the thread comes round to the hole, it is, of consequence, broken, and the whole contains nothing but ends.

3. The *cacalons* are a little larger than the others; yet they do not contain more silk, because their contexture is not so strong.

4. The *doupion*, or double cocoons, are so called, because they contain two, and sometimes three worms. They interlace their threads and make the silk called *doupion*.

5. The soufflons are imperfect cocoons, the contexture of which is loose, sometimes to that degree that they are transparent, and bear the same proportion to a good cocoon, as a gauze to a satin. These cannot be wound.

6. The *perforated* cocoons are so called, because they have a hole at one end; for which reason they cannot be *wound*.

7. The *calcined* cocoons are those in which the worm, after the formation of the cocoon, is attacked with a sickness, which sometimes petrifies it, and at other times, reduces it to a fine white powder, without in the least damaging the silk. On the contrary, these cocoons produce more silk than the others, because the worms are lighter. They are to be distingushed by the noise the petrified worm makes when the cocoon is shaken.

8. The *good choquettes* consist of those cocoons in which the worm dies before it is brought to perfection. They can be distinguished from the others, because they do not rattle when shaken. They produce as fine silk as the others; but should be wound separately, as they are subject to furze out, and the silk is neither of as bright a color, nor so strong as the rest.

9. The *bad choquette* is composed of defective cocoons, spotted or rotten: many of them may be wound together, but make very foul, bad silk of a blackish color.

HOW TO JUDGE A COCOON.

To judge whether a cocoon be good, observe if it be firm and sound: if it has a firm grain, and the two ends round and strong and capable of resisting pressure between the thumb and the finger. The cocoons of a bright yellow, yield more silk than the others, because they have more gum. Pale cocoons leave less gum, lose less in winding, and take a better white or pale blue.

GATHERING OF THE COCOONS.

Strong healthy worms, in three days and half from their time of moulting, will complete their cocoons, and this period may be shortened by increasing the temperature of the apartment. On the other hand their labors are prolonged by a colder temperature than has been fixed, as also by feeble health. Transitions from heat to cold, as well as a vitiated atmosphere and sudden draughts of wind before the cocoons are sufficiently advanced to afford them shelter, are injurious. The cocoons will be

fit to be taken off from the 7th to the 10th day. The gathering must be commenced below and continued upwards, and the cocoons that feel *soft* should be kept by themselves. When the cocoons are detached, the down or floss, in which the silk worms have formed the cocoons, should be taken off. The floss silk ought also to be collected and kept separate.

CHOOSING THE COCOONS FOR THE PRODUCTION OF EGGS.

About two ounces of eggs, which will yield, allowances being made for accidents, 40,000 worms. The small cocoons of a straw color, with hard ends and fine webs, and which are a little depressed in the middle, as if tightened by a ring or circle, are to be preferred. There are no certain signs to distinguish the male from the female cocoons; the best known are the following:

The smaller cocoons, sharp at one or both ends, and depressed in the middle, generally produce the males; the round full cocoons, without ring or depression in the middle, usually contain the females. As, however, all marks may fail, an extra number of the best should be taken for eggs, and when the moths come out, the males and females being easily distinguished, an addition, should there be a deficiency of either sex, can be made, from the double cocoons, to the defective side. In the seed cocoons, however, the double ones are to be avoided, and only to be resorted to, to supply a deficiency.

By shaking the cocoon close to the ear, we may generally ascertain whether the chrysalis be alive. If it be alive and loosened from the cocoon, it yields a sharp sound, when dead it yields a dumb one, and is more confined in the cocoon.

If white silk be desired, the choice must he made among the white cocoons exclusively. The cocoons intended for seed should be stript of the floss, that the moth may not be embarrassed when it first appears, and the cocoons thus sorted, should be laid separate. It is recommended by some writers, that the selection of cocoons for seed should be from among those that were spun the earliest, but we hardly think that can be considered essential. The cocoons when selected for seed should be spread out thin, and in from two to two and a half days the moths will come out, when they should be placed in pairs, male and female, on the paper arches to be formed across the room, as described by Mr. Smith in page 46, and there permitted to couple and lay eggs. Each healthy female will lay about 450 eggs.

While the moths are coupling they should not be disturbed by noise, but be permitted to *enjoy* each other's society in quiet; the room should be darkened, and its temperature kept at from 66° to 73°.

If there be an excess of males, they must be thrown away; if of females, males must be allotted to them, which have already been in a state of union. The male ought not to remain united more than six hours; after the expiration of that time they should be gently separated. As the males are disunited, they must be put upon the frame to be in readiness to attend to the calls of any females that may require being *served*: the preference, of course, to be given to the most vigorous.

KILLING OF THE CHRYSALIDS.

The killing of the chrysalids must be attended to as soon after the gathering of the cocoons as possible, to prevent their being pierced by the moth, whereby the web would be injured. Each silk pod consists of one single thread, the length of which varies from 900 to 1,200 feet. We have already given Mr. Smith's plan for effecting this part of the process, and we will now state the several other modes pursued in Europe.

The *Italian method* simply consists in exposing the grub in the cocoons to the ardent *heat* of the sun, during three days, when the thermometer is at 88° 2 Fahr. from 10 o'clock, A. M. until 4 o'clock, P. M.

The *French* plan is to put the cocoons into an oven in a bag, with the temperature standing at 88° 2 Fahr. The oven being shut and the bags frequently stirred, the grubs are killed within 4 hours.

In *Germany* they are killed by steam proceeding from boiling water. A kettle of boiling water being prepared, fixed in the wall, a clean basket is then placed over it upon two pieces of wood; cover the basket with three or four folds of woollen cloths that the steam may penetrate completely. The water in the pot must be kept boiling for three hours, which will be sufficient to kill the chrysalids, which can be ascertained by opening one of the cocoons. They must then remain undisturbed until the following day, when they will have been sufficiently hardened to be removed, being then fit for reeling or for sale. Suffocating with brimstone, or turpentine oil, are sometimes adopted; but we think neither are to be recommended.

The process of killing the chrysalids, should be gone through with, within twelve days after the completion of the cocoons, and the sooner thereafter the better.

PRESERVATION OF THE EGGS.

Collect the papers on which the eggs are laid, when *quite dry*, fold them up and put them away in tin boxes, in thin layers. They should be kept in a *dry*, cool cellar, or some other cool place, where the temperature does not exceed 65° nor descend below the freezing point 32°---where water will not freeze.

Being thus placed, they may remain there until the following spring, when the time to hatch them shall have arrived.

PROPORTION OF EGGS TO COCOONS.

The relative proportion of eggs, depends very much upon the care and attention that may be paid to the feeding of the worms, the degree of nutrition in the leaves, the vigor with which they may have fed, and the degree of health maintained during the feeding season. The cocoons are like all other crops, some heavier, and some lighter than others. In Tuscany, 150 cocoons have made a pound. In the early settlement of Georgia, 200 cocoons from worms raised in that state, weighed one pound; but these were extraordinary cocoons, and, therefore, cannot fairly be taken as the basis of a calculation; because it has severally taken, in other places, 208, 240, 262, 297, 271, 306, 328, 490 and 600 to make a pound. We have adopted as our *ratio* 300, which with ordinary care, we think may be assumed as a

safe one. With respect to the gross quantity of silk produced from an ounce of eggs, there is the same difference: all depending upon the assiduity and energy of the culturist, who, as he wills it, may either produce 40 or 120 pounds of cocoons. Instances have been given, and are well authenticated, where, in an establishment in which 6 ounces were annually hatched for 10 consecutive years, the average yield to the ounce of eggs, was 100 pounds of cocoons, or 11 1-9 pounds of raw silk. Now if the *casualties* had reduced the worms down to our standard of 20,000 to an ounce of eggs, and that is about the fair average number, then an acre would produce 305 pounds of silk. This is a very large yield, and of course should not be relied upon, or at all events no one should be disappointed at a greatly-diminished production, though we by no means would discourage the hope, that even a larger produce might not be raised in either New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Louisiana, Alabama or Mississippi.

Our table, it will have been perceived, sets 22,640 eggs as the number contained in an ounce; this is arbitrary, having deducted nearly 33 per cent. as the presumed loss.

ENEMIES OF SILK WORMS.

Red Ants. These are deadly insects to silk worms. To prevent their attacks, the posts containing fixed shelves ought not to touch the ceiling, nor must the shelves reach the walls, and their legs should either be smeared with Molasses, or placed in basins of water; or perhaps both would be best.

The smaller varieties of birds are very fond of them, but as these would not enter while there are persons in the apartment, there is not much danger to be apprehended from them.

Fowls, *mice, rats,* weazles, lizards and spiders, are also their enemies. If the apartment be infested with mice and rats, they must be trapped and killed: from weazles and lizards not much need be feared, and as for the spider, though a deadly and destructive foe, the *broom* must be made to render him his quietus.

DISEASES OF THE WORMS.

It may be assumed as a sound proposition, that nearly all the diseases to which this noble insect are subject, arise from *foul* air, or from an *irregular* or *overheated* apartment; from exposure to sudden atmospheric transitions; from too close crowding; from the too great accumulation of filth, and from improper food. There may be cases where the exciting cause of disease springs from some particular condition of the air, against which prudence, foresight, and art, cannot avail. And as it is useless to speculate upon that over which we have no control, and which depends upon contingences that may or may not occur, let us rather turn our attention to those enumerated diseases, the cause of which we know.

DISEASES FROM DEFECTS IN EGGS.

When the eggs are too thickly heaped together, they become heated even at a low temperature, and the embryo becomes injured: there are also other causes which injuriously affect the eggs, such as the imperfect impregnation of the eggs [dubio,] and dampness; but all these, except the defective impregnation, may be guarded against.

It is maintained that no disease will occur, if the temperature of the place where the moths are kept, be maintained between 68° and 70°, when the apartments are dry and free from vitiated air, and when the eggs are carefully kept. Low marshy places are unfavorable, as heat and moisture is highly injurious to their healthful existence—high dry situations are always the best, both for the worms and the Mulberry.

DISEASE FROM IMPURITY OF THE AIR OF THE LABORATORY.

It is surprising to find how large a portion of mephitic air disengages in a large establishment, particularly in the fourth and fifth ages from the silk worms. The damp stagnates in it, the transpiration is checked, the dung and litter undergo the process of fermentation and emit noxious exhalations; the skins of the worms become relaxed, and disease follows in a few hours, and hence the necessity of using the means, which we have before alluded to, of ensuring a renewal of pure air by the expulsion of the heavier, and replacing it by light, fresh, exterior air. The burning of shavings in the fire places or stoves, or the fumigation of the apartment, are the most efficient means; indeed they are the only ones to be relied upon. It may be well to remark here, that if cleanliness be observed, it will scarcely ever be necessary to apply other means than the solutions of chloride of lime; and to be candid, we believe this agent the best under any circumstances. Its affinity for putrescent animal matter is proverbial; nor is it less so with fermenting vegetable substances. Count Dandolo, however, has the following recipe which he recommends, as being eminently active as an anti-putrescent agent:

Take 6 ounces common salt, mix it well with 8 ounces of oxyde of manganese: put this mixture in a strong bottle with 2 ounces of water, cork it well. Keep this bottle in a part of the laboratory farthest from the stoves or fire places. In a phial put 1¼ lbs. of sulphuric acid, (oil of vitriol,) and keep it near the bottle, with a small wine glass and an iron spoon. Put in the wine glass two-thirds of a spoonful of oil of vitriol, pour it into the large bottle, and there will issue a white vapor. Move the bottle about the laboratory, holding it up high to let the vapor spread through the air. When the vapor ceases, cork up the bottle and replace it. During the fifth age of the worms, it is good to repeat this fumigation three or four times a day. During each successive repetition, the quantity of oil of vitriol may be diminished. The quantity stated is sufficient for a laboratory of 5 ounces of eggs.

The necessity for the use of this remedy may always be known by the presence of an unpleasant effluvia in the room, or a closeness of the air and difficulty of breathing.

The fumigation should always be renewed after each cleansing of the hurdles or shelves, and in moist damp weather.

The use of oil of vitriol, is, as the reader is sensible, subject to its dangers. If dropped upon the clothes or skin, it will burn, and its vapor if inhaled too closely, would be injurious. The way to guard

against its bad effects, is to hold it above the head, and thus avoid its searching, dangerous and unpleasant exhalations. Should the mixture in the bottle harden, dilute it with water.

The following is given as the good effects of fumigation:

1. It destroys unpleasant effluvia: 2. it diminishes fermentation: 3. it neutralizes the effects of miasmata and deleterious emanations: 4. it revives the silk worms, by means of the gentle stimulating effect of pure vital air:—and 5thly, it influences the goodness of the cocoon. This fumigating preparation would cost about 30 cents.

Disease from change of food. If the diet of the worms after being fed on one kind of leaves, or food of any kind, be changed to another more congenial to their appetites, great danger is to be apprehended from their eating to bursting; the feeder, must, therefore, use his judgment in feeding them sparingly at the onset.

Diseases also arise from a peculiar constitution and from sudden changes of the air; but these can be easily guarded against by observing what we have already said on this subject.

PARTICULAR DISEASES.

The passis. This disease appears after the first moulting, when the worms advance unequally in growth: they are observed to be short, thin and without vigor or appetite: it is ascribed to their being too much heated in their early state. The remedies consist in separating them from healthy worms, putting them in another apartment, well ventilated, giving them tender leaves, and in preserving them in an uniform temperature, a little higher than that in which the healthy ones are kept.

The Grasserie. This disease appears towards the second moulting, and in the third or fourth ages. Its cause is ascribed to the food being too substantial or nourishing for the young worms, occasioning indigestion; hence they swell, their bodies become opaque and of a green color, and their skins tear from the least touch, and sometimes, spontaneously from over distension. Their bodies are also covered with an oily, viscous humour which transudes the skin. If this be the cause it is an easy matter to prevent the occurrence of the disease, by feeding the young worms through the first, second and third ages, with young tender leaves.

The Lusette. About the fifth age, silk worms are attacked with a disease called *lusette* or *clairette*, from the shining appearance of their bodies. Their heads also increase in size, and they ultimately die without forming their cocoons. The cause is neglect in the regular supply of leaves. The means of prevention as well as cure are easy. Regularity in feeding effects the first, and separation of the silk from healthy worms, and the supplying of the invalids with food in a gradual manner, so as to restore them without subjecting them to an opposite disease arising from a too sudden repletion, is the last.

The yellows. This disease appears towards the end of the fifth age, when the worms are filled with the silky fluid and are about to spin. It proceeds from exposure to sudden intense heat, and its symptoms are yellowness and swelling of the body, an enlargement of the rings, an appearance of the feet being drawn up from the puffiness of the surrounding parts. They cease to eat and run about, leaving stains of a yellow fluid, which exudes from their bodies. The yellowness first appears round the spiracles or breathing holes, and gradually diffuses itself over the body. It may be called a dropsy of the skin, arising from the infiltration of the nutritive fluid through every part of their bodies, and they soon become soft and burst. The acid humour issuing from them, will kill any worms that touch it. This disease has its origin in indigestible food and exposure to cold during rainy weather. The diseased worms must be removed to a separate apartment, where a change of air, aided by fires, may cure them. Oak leaves fed to the worms in two instances effected a cure.

The *muscardine* or *numbness.* This disease shews itself in the fifth age, by black spots in different parts of the worm. These spots afterwards become yellow, and finally red, or the color of cinnamon, which is diffused over the whole body; the worm becomes hard and dry, and is covered with a white mould. The remedy is fumigation and admission of fresh air.

The *tripes*, or *mort blanc.* This disease appears generally during moist or rainy weather, but is sometimes produced by the confined exhalations of the worms and their litter. The symptoms are, the worms become flaccid and soft, and when dead, preserve the semblance of life and death; but they soon turn black and become putrid. The *remedies* are—the atmosphere of the apartment should be warmed, and made to circulate by lighting brisk fires in the chimney; and by the removal of the diseased worms to another room.

This is a most formidable array of diseases, but the discriminating reader will have perceived, that they are in fact nearly one and all the same disease, assuming, to be sure, somewhat different types and forms, but all referrible to the same general causes, viz:—*impure air, too contracted room, exposure to sudden atmospheric transitions, to irregular feeding, over feeding, stinted feeding*, and to *improper food:* so that after all, there is not one exciting cause in the whole catalogue of diseases, that is not perfectly within the control of the culturist, and, therefore, if his worms suffer by sickness, the fault is with himself; for there is not one of those maladies which may not be prevented by proper attention to *feeding* and *temperature.* There is nothing more simple in all its bearings than the management of the worms, if the proper vigilance be resorted to, to preserve them in the possession of health; but if negligence and wanton neglect be indulged in, these causes will assuredly prove destructive to the interests of the culturist, in the generation of disease and production of mortality among his worms. For ourself, we regard the *diseases* enumerated as of little account, because in the vigilance, energy, and good sense, of such of the American people as may engage in it, we behold the sure guaranties that nothing will be jeoparded or lost by want of attention and care. Indeed, we hold these diseases to be of such trifling account, that did we not desire to deal with perfect ingenuousness, we should not have named one of them, as we believe they are formidable only in name, and may *all* be prevented by following the rules prescribed.

VARIETIES OF THE SILK WORMS.

Count *Dandolo* describes the following distinct varieties of silk worms, viz:

1. *Silk worms of three casts or moultings.* The eggs of this kind are to be found in Lombardy; the worms and cocoons are two-fifths smaller than those of the common sort. Their cocoons are composed of finer and more beautiful silk than the common cocoon, are better constructed, and according to weight yield a greater quantity of silk; require four days less care than the common worms; are strong and hardy, and promote a saving of time, labor and money.

2. *Large silk worms of four casts.* These worms are of a very large quality, the eggs were obtained in Friuli; they yield a much larger cocoon than the common species; 150 of the large sort weigh a pound and a half, while it requires 360 and upwards of the ordinary cocoons to weigh as much. The silk is coarser and not

near so pure, and the worms five or six days later than the others in attaining their full growth, and in rising, than the common silk worm.

3. *Worms that produce white silk.* This species was introduced into *France* about fifty-two years ago, from *China*, but was not much cultivated until about 24 years past, and is much prized.

Count Dandolo says, that he has raised a large quantity of these, and found them in all respects equal to the common silk worms of four casts. That if he reared silk worms for the purpose of spinning the silk himself, he would cultivate only the silk worms of three casts, and those that produce white silk, as preferable to all others, and every year would choose the very whitest and finest cocoons, to prevent the degeneration of the species.

The following varieties may also be added to the number:

4. In Windham county, Connecticut, there is a small pale white worm, which it is said eats but twenty days, and produces fine white silk, though in less quantity than either the common large pale white, or dark colored worm; but it has the good quality of retaining its clear white color, and does not turn white by washing or by exposure to sun and air. These worms also produce two crops.

5. *A dark drab colored worm.* This variety is very common in the U. States, and are called "black"—they live longer and make more silk than the large white worms.

6. *Silk worms of 8 crops.* At the silk establishment of the British East India Company at Jungepore, Bengal, Lord Valencia, besides the common annual silk worm which gave but one crop, found two others; the one commonly reared, and supposed to be indigenous, is called Dacey, producing 8 harvests—also another, but greatly inferior, called the *China*, or *Madrassa*, which yields 8 times a year.

The following instances we copy from the Treasury Manual, to show that two crops a year have been raised in the United States; and to use a very trite adage, what has been done, may be done again,—therefore, we incline to the belief, that it is within the power of a vigilant culturist, residing in those States, in which the heat of summer continues long, to make double crops; but then, we question much, whether any calculations should be predicated upon such results, as they must necessarily depend for success upon circumstances, in our eccentric climate, too uncertain to rest any well grounded hopes upon.

"In the month of March, 1826, Mr. Seth Millington, *Prairie Haut*, St. Charles Co., Missouri, received a few silk worm eggs from Philadelphia, which were kept in an upper room without a fire, and hatched early in April: they were fed the first week on lettuce, afterwards on the leaves of the White and native Mulberry tree, and came to maturity, within from twenty-four to thirty days, and spun their cocoons before the 12th of May.

On the last day of May and first day of June, the moths came out and laid their eggs on paper, which was loosely rolled up and placed in an open room. Within 8 or 10 days from the time the eggs were laid, they began to hatch, and before the 15th of June, nearly one-twentieth part had hatched; and the worms were healthy, fed well, grew more rapidly and came to maturity in a few days less time, than the first crop. They wound their cocoons on the first day of July; or the last of that month, and first of August, the moths came forth and laid their eggs, which were placed in the same room as the first eggs. On the 12th and 18th of August, these eggs were hatched. The worms came to maturity and spun their cocoons in less time than the first, viz: before the middle of September, the moths came forth and laid their eggs in the first days of October."

"Messrs. Weiss and Youngman, of Bethlehem, Pa. raised two crops during the year 1825. The worms of the second crop appeared more vigorous and healthy than those of the first; they also produced large cocoons, the silk of which was of a better quality.

"Two attempts, however, by Messrs. Terhoeven, of Philadelphia county, Pa., in the years 1826 and 1827 failed."

REELING.

We have now arrived at a branch of the culture of the most vital importance to the success of the whole, and we feel especially solicitous to lay before the reader a frank exposition upon this head. It is the *supposed* difficulty of reeling that has hitherto deterred hundreds from entering into the business, and, indeed, to that cause, together with the want of a *market*, may be ascribed the snail-like march it has hitherto made towards being adopted as a component part of the husbandry of the country. Much difficulty too has been experienced in the obtainment of *reels*. This latter cause, however, has ceased to exist, as reels of the most simple structure are now to be had at moderate prices, and a knowledge of the use of these is so easy of acquisition, as to have stript this particular part of the culture of all the repulsiveness with which it was formerly surrounded. Those who enter into the business with a view of prosecuting it on a large scale and of combining them anufacture of silk with it, will not need to be instructed; but the farmer or planter who may have entered into it merely as a branch of his system of husbandry, will require to be inducted into the mode of preparing his silk for market. And we would advise all such to submit their cocoons to the process of reeling, because in so doing they will impart a greatly *enhanced value* to the article, and we would especially recommend them so to do, as the requisite labor may all be performed by the *females* of their respective families, who will be enabled through a labor no less interesting than useful, to greatly add to the aggregate amount of the productions of the country, and instead of being burthens upon those upon whom they may be dependent, will become at once among the most profitable branches of every farming establishment. Nor is the labor of reeling the less valuable, because it can be performed at periods of leisure; but as we would advise in almost every other matter, so in this, the cocoons should be reeled as speedily as possible, and especially those that are defective, as they will deteriorate by being permitted to remain unwound for any length of time.

Before we enter upon the description of the process of reeling, we would respectfully offer a word of *advice* to each and every person who may contemplate entering into the business. It is this.

Those who may commence the silk business as a branch of their respective systems of husbandry, after having sown their Mulberry seed, should procure a small quantity of silk worm eggs, with which we advise, that they should practice upon our instructions. Should they do so, this good will result from it—by the time their orchards of Mulberry are fit to feed from, they will have become perfect masters of the management of the worms, the cocoons and the method of reeling the silk. If we are asked, where they will get the *leaves* from with which to feed the worms, we answer, in most cases, even the first year, they will be able to abstract a sufficiency of leaves from the Mulberry plants, without injury to them, to feed the few worms necessary to be fed as a *school*. Five hundred or a thousand eggs would be sufficient to commence with, and these could be afterwards multiplied, so that, by the time the orchards were of sufficient age for strip-

ping, the party might have the requisite number of eggs on hand, without further cost, to feed all the leaves he might raise. The intelligent reader will discover at a single glance the object we have in view, and will doubtless, improve upon our suggestion. Our anxiety to get our countrymen to enter liberally into this culture, arises from the honest conviction entertained by us, that it is more profitable than any thing else within the range of the agricultural calling, and because we behold in it the certain means of employment to the thousands and tens of thousands of destitute females, who are now dragging out a precarious livelihood throughout our wide spread country, and because we also behold in it, an antidote for that spirit of desolating emigration, which is driving the honest and enterprising from the haunts of their youth, to distant lands, and depopulating the members of that gallant confederacy, which achieved our freedom. Thus influenced, it will be readily perceived, we were solicitous that success should attend those who should be induced to adventure in the silk culture, and hence it is, we advise all to acquire a thorough knowledge of the art, by practising in the way we recommend—a way which, while it embodies every advantage of a school of experiment, comparatively costs nothing.

METHOD OF REELING.

A person charged with the business of reeling the cocoons, whom we will suppose to be a woman, must be provided with a basin of soft, hot water, to be kept at the proper heat, by being placed upon a small earthen or iron furnace, containing burning charcoal; she must have a small whisk of broom corn, or of birch twigs, cut sharp at the points, and being seated behind the basin, she must throw into the water a handful or two of cocoons of the same quality; press them gently under the water for two or three minutes, in order to soften the gum of the silk, and thereby to loosen the ends of the filaments. She is then to stir the cocoons with the end of the whisk or birchen rods, as lightly as possible, *barely* touching the cocoons, as should they be roughly struck, the fibres of the silk instead of coming off singly, will cling together in lumps, which prevents it from winding off. She will continue the stirring until one of the fibres or filaments adheres to it, when disengaging it, and laying aside the whisk, she is to draw the filaments towards her, until they come off quite clean from the floss or coarse silk, which always surrounds the cocoon, and the fine silk begins to appear: then, breaking off the thread and collecting the floss first taken off, she will run the thread through one of the holes in the iron plate, and proceed to get, and attach, others in a similar way, until a sufficient number is obtained to make the thread of the required firmness; a second thread is formed the same way, and passed through the adjoining hole: the two threads are then crossed several times around each other, and the ends of each passed through the guide hooks of the traversing bar, and on the contrary side to the hole in the iron plate, through which it had been previously passed. They are then to be carried from, and made fast to, one of the arms of the reel. The points of attachment of the two threads will be regulated by the reeler, who should have smooth fingers, as roughness of the skin will cause great embarrassment. If, therefore, the skin of the reeler's fingers be rough, they should be rendered smooth by being rubbed with sand paper, or dog fish skin. Both threads being fastened to the reel, it is to be turned with a regular and even motion; at first slowly, until the threads are found to run freely and easily. The crossing of the threads is essential to their perfection, and must not be omitted. The friction of the threads removes any inequalities and roughness upon them, and insures strength, uniform thickness, and cylindrical form, which would otherwise be flat.

As soon as the pods begin to give the thread freely, the reel is turned with a quicker motion. While the reel is turning, the spinner must continually add fresh fibres to each thread as fast as she can find the ends, not waiting till some of the number she began with are ended, because the internal fibres are much thinner than those constituting the external layers; but must constantly prepare fresh ends, by dipping the whisk among fresh cocoons, of which such a quantity must be occasionally thrown into the basin as will suffice to supply the two threads which are reeling, but not more; because by being too long soaked in the hot water, they would wind off in burrs. The cocoons thrown in, must be often forced under the water, that they may be equally soaked. The supplying fresh ends, is a business which every woman who can spin will fully understand. She will know, when the cocoon is exhausted, or its fibres break, she must take the end of another fibre and throw it lightly on the one that is winding and roll them between the thumb and the finger, gently pressing them together, so as to cause a juncture of the threads. The adroitness in adding fresh threads can only be acquired by practice; but by proper attention, that peculiar *tact*, so necessary to success can easily be acquired.

If the pods leap up often, the motion of the wheel must be slackened, and if the threads come off in burrs, it must be turned quicker. Of this, the spinner, who has her eyes upon the balls and thread, must, as she sees occasion, apprise the reeler, and at the same time, the fire must be increased or diminished, that the reel be allowed a proper motion, which ought to be as quick as possible without endangering the breaking of the thread, or hurrying the spinner, so that she cannot add fresh cocoons as fast as the old ones are ended. The quicker the motion of the wheel is the better the silk winds off, and the better the end joins to the thread.

Every care must be observed to avoid the breaking of the whole thread or single fibres, as every such occurrence greatly retards the operation.

In preparing *fine silk*, in Cevennes, a famous silk district of France, the cocoons are not wound off entirely, so as to leave the pellicle of the chrysalis bare; first—because the additional fibres required to be added, when the first and strong part of the fibre is observed to be spent, might make the compound thread too stout, and would thus cause a waste of silk; secondly, because the fibre of a cocoon which has been entirely wound off, besides being weak, also abounds in knots, which would cause it to break in winding, and injure its uniformity, in which the goodness of the thread mainly consists. Therefore, in winding fine silk, when the cocoon has given off three-fourths and a half of silk, it must be replaced by another cocoon: the remainder of the first cocoons are to be set aside, and their silk added to that of an inferior quality. When the first parcel of cocoons is nearly finished, take out with a ladle all those on which some silk has been left; let them be opened, the chrysalids taken out, and the shells put in a basket, with the coarse fibres first pulled off with the hands from the cocoons, which were ordered to be laid aside. Those cocoons which are partly wound off, must on no account be permitted to remain in the basin; for they will obscure and thicken the water, and injure the color and lustre of the silk, which can then be used only for dark colors;—besides this, the consistence of the silk is injured, and waste ensues in the winding. The shells must be added to the manure heap; and as a general rule, it may be laid down as essential, that the water in the basin must be changed whenever it becomes discolored.

The softest water must always be chosen for reeling of the silk, and although its precise temperature can-

not be laid down, because that, in a great measure, must depend upon the composition of the silk of the cocoons, which cannot be ascertained until the reeling has commenced. Such is the difference in cocoons, that while some can be reeled from water heated from 160° and indeed less, others will require a temperature of 200°. Some point between 150 and 190 is probably the right one, but what that point is can easily be ascertained, as whenever the cocoons yield *freely*, it has been already found, and the heat of the water should be maintained at it. By immersing the thermometer in the water at any time, the precise required heat can be determined, and may be preserved at that by submitting the water repeatedly to the test of the instrument. The water should never exceed 200°, and never that or any thing like it, unless absolutely required by the condition of the cocoons, and in order to arrive at the exact heat wanted, the increase should be gradually carried forward. There is no mystery at arriving at this point—all that is requisite is attention: with this the person engaged in reeling will be able to graduate the temperature with the least difficulty.

When the spent cocoons leap up and adhere to the iron plate, they must be immediately taken away, else by choking the passage, they will endanger the breaking of the thread.

When the reel has remained any time idle, the thread between the basin and the wires or vampins, must be wet to cause the thread to run easily. Keep also the teeth of the wheels, and the mortises in which the traversing bar plays, wet, to ensure regularity and ease to their movements. In winding the good cocoons, some defective ones will be found among them, which will not wind off, or are full of knots. These must be taken out of the copper, and be kept by themselves; they are called bassinats, and are to be wound apart as coarse as possible: they make a foul silk.

The breaking of the fibres is principally owing either to bad cocoons, viz: being ill formed owing to the worms being disturbed during their spinning:—or the fibres may break by an improper regulation of heat in the water: first, when it is not sufficient to make them wind off easy; or, second, when it is too great, and occasions burrs, which may stop at some of the holes through which the thread runs. Cocoons also which have two worms enclosed, will perpetually break. The whole thread may also break, by burrs stopping at the holes of the plate or by the reels being turned by jerks. It may be fastened like the fibres, by laying the parts on one another, and giving them a little twist. To avoid the breaking, occasioned by burrs, the rampins should be just so wide as to let them easily pass.

It would be convenient for the spinner to have a little stick erected close to the side of the basin, to hang her wisk on, and also a sharp fork, with which she may draw away the spent cocoons, or such as being near spent, stick in the holes in the plate: and as the whisk will frequently take up more ends than are immediately to be added, and as the spinner will sometimes have occasion to employ both her hands, the brush will, at that time, conveniently hang by the basin, while the cocoons, which are attached to it, remain in the water, and the ends will be in readiness as they are wanted. When the cocoons rise to the iron plate, they are to be drawn down between the fingers of the spread hand.

If the spinner be under the necessity of leaving off work for any length of time, the cocoons should all be raised with a skimmer out of the water, till her return, otherwise by oversoaking they would run off in burrs; but it is best to continue the reeling without interruption, and let fresh, but equally experienced persons succeed those who are tired.

As the heat of the water of the basin will require to be varied according to the ease or difficulty with which the different sorts of cocoons give off their silk, the spinner should always have some cold water within reach, in order to cool that in the basin quickly, when the silk comes off too easily, and in burrs. The water is also necessary for the woman managing the cocoons, to cool her fingers, and to sprinkle the iron bar when it becomes heated. Some light wood, chips or shavings, should also be at hand to increase the heat quickly, when the cocoons do not yield their silk readily. The water in which the cocoons are heated must be pure, soft and clear of sand or settlings.

When the cocoons are first put in the water, if the silk rises thick upon the brush, or gets in lumps, it is a sign the water is too hot: if the thread cannot be caught, the water is too cold. When the cocoons are in play, if they rise often to the holes in the iron plate, the water is too hot; if the cocoon do not follow the threads, it is too cold.

Keep an equal number of cocoons working at each end of the basin in order to preserve the thread of silk to an equal size. When there are fewer on one side than the other, the silk becomes smaller at that side, and the thread will break. Therefore, throw in the cocoons one by one, and never throw two at a time.

It will be seen by observing the position of the thread upon the reel, that the different layers do not lie parallel to, nor upon, but across one another. This is owing to the mechanism of the apparatus, and is particularly contrived to effect this object; which is essential to the perfection of the process, and one to which the acknowledged superiority of the Italian silk is to be ascribed. It is effected by the seesaw or horizontal motion of the traversing bar, and is produced by the different number of the teeth in the pinion of the axle, and in the wheels at the ends of the shaft, and in the pinions on the top of the post, which catch and work upon one another. Without this crossing, the threads, from their gummy nature, would inevitably adhere, and render the subsequent windings and twistings of the silk very difficult; causing the threads frequently to break, and when joined to form knots, which, in weaving, cannot pass through the reeds, and hence injure the beauty of the stuffs. But the mechanism mentioned of the traversing bar, prevents the threads lying over each upon the other, upon the reel, until after it has made many revolutions. It is stated by *Borgnis* in the *Traite de Mechanique*, that the silk fibres of the cocoons are spun in zigzags, like those formed by the silk reel, and, consequently, the operation of the reel is an imitation of nature, of which the industry of the catterpillar, instructed by her, is the prototype.

Count *Dandolo*, says, that it is a well known fact, that of two reelers, each reeling 7 1-2 pounds of cocoons of the same quality, one will obtain only six ounces and a half, or, perhaps still less, while another will turn off eight ounces.

A woman experienced in the business, with a girl to turn the wheel and attend the fire under the cauldron, can, with ease, reel off one pound of silk per day, consisting of four or five cocoons of the most perfect quality.

When a desired quantity of silk has been wound on the reel, pick off all the loose silk; then take a little handful of the coarse silk, and after washing and squeezing it, dip it in cold water, and rub over the silk on the reel, stroking up also the silk with the palm of the hand: then turn the wheel with all possible velocity, with open windows, if the reeling has been done in a room for eight or ten minutes to dry the silk effectually; which done, take it off the reel, put it in a dry, airy place, but not in the sun. This is done to clear the silk and give it a gloss.

When one reel is taken off, another should be put on, that the work may not be delayed. Every winding apparatus must have two reels.

In preparing the dupions for winding off, more are put into the basin at once than of the finest kind. They must be first well cleaned from the floss on their outsides. The water also must be boiling hot; and as the silk they yield is of a coarser quality than the other, and has a good deal of the floss upon it, the person who turns the reel must take the opportunity, while the one who manages the basin is preparing the cocoons for winding, to clear and pick off the loose silk from that which is on the reel. The *dupions* intended for ordinary sewing silk, are to be wound from 15 to 20 cocoons. The rest may be wound as coarse as possible, that is, from 40 to 50 cocoons. These serve to cover and fill up in coarse stuffs, and are likewise for sewing silk. The *good* choquettes are to be wound according to the uses they are intended to be put to, but not finer than from seven to eight. The *bad choquettes* may be wound from 15 to 20. The *satin cocoons*, so called from their resemblance to satin, require water only moderately hot. The proper heat will be found by observing the manner in which the silk comes off from the first of them which are put into the basin; and, as already said of cocoons generally, if it come off thick, cold water must be added, until the proper temperature be attained. They must not be allowed to remain long in the water, and there should be only a few of these cocoons put in at a time. The water for the *dupions* and choquettes must be changed four times a day.

It may, perhaps, be profitable to give the views of others, upon this particular branch of the business, as it is the process of reeling which imparts so much to the value of the silk. If done indifferently it may not be worth more than *four dollars* per pound; but if *well* and *skilfully* executed, it may be worth from *six* to *seven dollars* per pound according to the demand and state of the market.

Loudon says:

"The cocoons, or produce of the worms, as soon as completed, are either reeled off or sold to others to be reeled. The silk as formed by the worms is so fine, that if each ball or cocoon was reeled separately, it would be entirely unfit for the purposes of the manufacturer. In the reeling, therefore, after the cocoons are cleared from the floss, the ends of several are joined and reeled together out of warm water, which softening their natural gum, makes them stick together so as to form one strong smooth thread. As often as any single thread breaks or comes to an end, it is supplied by a new one, so that by continually keeping up the same number, the united threads may be wound to any length. The single threads of the newly added cocoons are not joined by any tie; but simply laid on the main thread, to which they adhere by their gum; and their ends are so fine as not to cause the least perceptible unevenness in the places where they are laid on. Care should be taken in the operation that the silk when reeled off may consist of a smooth thread of equal thickness and strength; but of a round form, having the small threads of which it is composed as equally stretched and firmly united as possible, and that the several rounds as they lie on the reel should not be glued together. When the skein is quite dry it is taken off the reel, and a tie is made with some of the refuse silk on that part of the skein where it bore upon the bar of the reel, and another tie on the opposite part of the skein, after which it is doubled into a hank, and usually tied round near the extremities, when it is laid by for use or sale."

Mr. *Kenrick* in his *Silk Grower's* Guide, states that "the use of the reel requires dexterity and practice. The cocoons, after being cleared of the floss, and thrown by handsful into basins of pure soft water, placed over small furnaces of charcoal. When the water is almost at boiling point, sink the cocoons with a whisk of broom corn under water for two or three minutes, to soften the gum and loosen the fibres. Then moving the whisk lightly, the filaments will adhere to it, and may be drawn off till the flossy silk is unwound, and the fine silk comes off. A sufficient number being collected, the reeling begins. If the pods leap upwards, the reel must be slackened; if the silk comes off in burrs, you must turn faster; if the water is too hot, they furze in unwinding, and the fine lustre of white silk is injured, and cold water must be added. It requires long practice dexterously to attend to the splicing on the fibres, to keep up an even thread, as the silk grows continually finer to the end of the cocoon."

Mr. *Cobb*, a practical culturist and extensive manufacturer gives the following as the method of reeling cocoons and manufacturing silk in Connecticut. "A large kettle set in a furnace, or in an arch, is filled with water, and fire is kept under it; and when it is about to boil a quart of cocoons is thrown into it," &c; and after describing other preparatory measures, he says, "Reeling is then commenced on a common hand reel (such as is in common use in families in New England for reeling yarn from the spinning wheel,) and the silk fibres run off about as fast and with as little difficulty as yarn from a spindle. Some of the cocoons run off before others, and when on this account the thread becomes too small, all the fibres are broken off, and what is reeled is tied up by itself on the reel, and another quart is then thrown into the kettle; the ends are collected and reeled in the same way as before, and each separate piece is tied by itself. When the reel is full, the pieces are all tied together, taken off, and immediately dried."

"Most of the silk is manufactured into sewing silk, and twist in the following manner: it is immersed for a few moments in boiling water, taken out, put on swifts and spun or twisted on a common wool wheel, beginning at the large end of the piece, that is at the end which was reeled first; and when it becomes too small, which is the case when one-half or two-thirds is run off, the small end of another piece is added to it, and thus they are twisted together. It is then spooled directly off the spindle, a sufficient number of spools is put into a small spool frame to make thread of a proper size, which is twisted again and cleansed by boiling in strong suds for three hours, then dried and colored. Undergoing this process it shrinks about one-half in weight: after this, for sewing silk, it is doubled, twisted and reeled on a reel two yards long, and is divided into skeins of twenty threads each, as the statute of the state requires. If it be calculated for twist, it is made three threaded, twisted, and done up into sticks with a small hand machine, and is then ready for the market. The floss or tow, as it is called, is boiled in strong suds for three hours, dried, picked, carded, and spun on a common wool wheel. The yarn is woven into cloth, usually worn by the women for every day gowns; and sometimes manufactured into strong and durable carpets.

Those cocoons that the grubs have pierced are boiled as above directed: the end that is not pierced is cut off; they are then spun on a *linen wheel* like worsted, beginning at the end cut. It is then twisted together, three threaded and knit into stockings.

The imperfect cocoons, and all that will not reel, are boiled, carded, spun and manufactured in all respects like floss, but they make nicer and finer cloth."

We have been thus full upon this part of the subject, for the reasons before assigned by us, that it is by means of the reeling, &c. that a large portion of the profit of the culturist arises. Indeed it may be said that those who are now engaged in the culture of silk, have to look to it for fully 25 per cent. of their profit, and hence it becomes doubly important that it should be well done.

MODE OF MAKING SEWING SILK, AND SILK TWIST IN CONNECTICUT.

The following is the method followed in Connecticut, as recommended to the secretary of the treasury by Daniel Bulkley, Esquire.

"The raw silk is first spooled on bobbins, the number of which is in proportion to the size of the intended thread from the first spinning, and, to facilitate the operation, they are put into warm water. The silk is again spooled, taking two or three bobbins, according to the size of the intended thread. After being spun, it is reeled into skeins, each of forty yards in length, or half a knot of the country reel, as required by a law of the state. About twenty-five of these skeins are put together, like a skein of cotton or woollen yarn. They are then boiled, adding a small quantity of soft soap, or ley of wood ashes, to cleanse them from the gum, they are then ready for dying.

Silk twist is spun in the same manner, except that it is always of three cords. The winding of twist is done on a machine imported from England."

We have a small establishment for spinning by water, with a machine similar to a throstle frame of a cotton mill. The silk is first spooled by hand on bobbins, which are placed on the top of the frame; the thread of raw silk passing from it under a wire through a trough of water, then through rollers to the spindle. A single frame may contain from thirty to fifty spindles, and can be attended to by one person. The doubling and twisting may be done by the same frame at the same time, by giving the bands to a part of the spindles of a contrary direction. As many threads are put to a spindle as are required to make a thread of two or three cords. Silk spun in this way is far superior to that done by hand. The machine will spin from two to three pounds in a day. A pound of silk after being spun and cleansed will weigh about ten ounces, and form one hundred and seventy skeins; the threads of sufficient size to sew woollens. If spun finer, it would make more. It increases little or nothing in weight when dyed. Silk is sold by the skein; one hundred of which will measure one-third more than half a pound of Italian, or English silk, of the same sized threads One woman can make from twelve to fifteen pounds of raw silk, in a season of six weeks."

PREPARATION OF WASTE SILK.

"All the cocoons pierced by the moths; those formed with holes at one or both ends; the light cocoons deemed improper for winding, after the insects have been cut out, or threshed out, and the pellicles remaining after winding of the silk, are to be collected; and if it be wished to retain the yellow color, they are put in a copper kettle with water, and trampled with the feet; turning the cocoons, and adding a little fresh water from time to time, until it be found that the silk separates properly, upon tedding it out with the fingers. They are then tied up in a clean cloth, which is dipped in a clear stream, or water is poured on them, until it runs off without color, and spread out to dry."

WASTE WHITE SILK.

"Waste silk intended to remain white, is to be treated in the following manner:

Put the cocoons in a kettle of cold water, and let them lie 24 hours: then boil them in a copper kettle, adding a quarter of a pound of soap for every pound of cocoons: when the soap is dissolved, tie up the cocoons in a clean cloth, put it in a kettle, and boil until the cocoons have become white. The water should entirely cover the cloth; then take out the cloth, and dip it in a clear stream, or pour water on it till it comes off clear; then spread out the cocoons in the sun to dry.

ON SPINNING INFERIOR QUALITIES OF SILK.

In every filature, one or more reels are devoted to the spinning with the carrelet, the inferior qualities of silk, which cannot be spun on the common reel. The carrelet, is thus described by M. *Reynauld*, of Paris. The frame is larger than the common silk reel, and has commonly a wheel with four arms. The most essential difference in the frames, is that of the head pieces. To these are added a board which carries two or four bobbins. If there are only two, they are placed longitudinally one above the other. If two threads are to be wound at a time, two other bobbins are added, and placed between the other two in the same position. After the cocoons have been threshed, a number of the fibres are collected to form a thread, which is passed through one of the two eyes of the board of the bobbins, of the same form as that of the traversing bar of the silk reel; then it is wound round both bobbins at the same time: being first carried to the first and returning round the second, it passess between them, giving a twist to the part of the fibre which was extended from one bobbin to the other. The spinner then takes the same end, and passes it through the eye of the traversing bar, and attaching it to the wheel, it is set in motion. If it be wished to wind two skeins at one time, a second thread is prepared, and attached to the second pair of cylinders or bobbins, whence it passed through the second eye of the traversing bar, and then fixed to the wheel at a proprr distance from the first end.

The silk called *fram*, which is slightly twisted, and used for the filling of stuffs and for inferior silk for bonnets; the *dupions* or double cocoons, are also reeled on the carrelet in France. These latter require softening in hot water five or six minutes.

In *France* the coarse fibres taken off the cocoons and laid aside, are called *fantasie;* it is first boiled, then carded and spun: the best of it is used for filling after being slightly twisted, and the inferior for the chain of stuffs. In *Connecticut* the coarse thread of the cocoons are made into a ball, then reeled, boiled in soap and water, rinsed, dried, cut into one and a half inch pieces, then carded on cotton cards and spun like wool or cotton.

The pointed cocoons, or such imperfect ones, as are made by feeble worms, or in cold seasons, when the temperature of the apartment is not attended to, are first deprived of their gum, by being immersed in water, or soap and water, dried, and then spun upon the wheel, and forms an even and fine thread.

In *Connecticut*, family sewing silk is made from the good cocoons, from which the moths have escaped. The shrivelled case of the pupa, and any eggs which may have been deposited in the cocoon, are first taken out; they are then boiled in soap and water, rinsed, gently squeezed, dried, and spun on a foot wheel. Knitting thread for stockings and mits, is also made from them. They make the best sewing silk, by doubling the thread, reeled from cocoons and twisting it on the common wheel. The skein is first boiled in soap and water, and it lies on a dish containing enough soap-suds to keep it moist, while the process of reeling is going on.

To organzine silk. The thread is first twisted from right to left. The silk in twisting, turns off on other bobbins somewhat larger than the first. These bobbins are then to be exposed to the stream of water, to which have been added two ounces of white, or castile soap, (the latter best,) 18 ounces of olive oil and four or five pounds of wood ashes. The bobbins are put in a kettle, the bottom of which is pierced, and placed on the vessel of water, when it boils with a cloth over it, and permitted to remain until the silk begins to swell, and to detach from the bobbins. They are then to be taken away, and the second throw or twist given to the

threads, from left to right. The combination of these two threads, is called the *pearl*, as the organzine looks like a string of small pearls or beads. It is easy to know if the second throw be perfect, by untwisting part of the organzine, and when it is open, or slackening the hand a little, each thread twists round itself in obedience to the first throw or twist. The water may be filled up as it wastes, but the ashes, soap and oil, are to be renewed every day.

MACHINERY.

It is not our purpose to give minute descriptions of the various reels, looms, and other machinery used in the preparation and manufacture of silk. Such an occupation of our pages, we deem wholly unnecessary, because it is not to be presumed that farmers will desire to become manufacturers of such implements, and, indeed, if they were so disposed, the immunities of the patent law would prevent them. We shall, therefore, content ourself with enumerating such of the most prominent inventions, as appear to us, by their merit, to demand notice. Indeed, more than this, in the present state of improvement, when the spirit of emulation is emphatically abroad, would be worse than supererogatory. Any individual entering into the silk culture, will, as a matter of sheer prudence, in the exercise of a sound discrimination, procure for himself the best of all such machinery as he may require to carry on such branches of the business, as it may be his peculiar pleasure to engage in; and with respect to the prosecution of the business by manufacturing companies, they will not require to be reminded of what particular kinds of machinery, or implements, they will need, their interest will at once dictate the procurement of such as is best adapted to the uses, to which they intend to appropriate them.

The brief notice below will suffice for all profitable uses of the farmer or planter:

1. The silk reel, of Piedmont.

2. *Gideon B. Smith's* improved silk reel—being an improvement upon the above, the operation being greatly simplified.

3. *Brooks' patent silk spinning and reeling machine.* This is represented as being a very simple and easy operating machine, and yet one of the most perfect that has been invented for the purpose of reeling and twisting silk from the cocoons, and manufacturing it into sewing silk.

4. *Gay and Moseley's reel, and silk power loom.* The following description of the latter improved machinery, we copy from that excellent and sensibly conducted periodical, "*The Silk Worm*," published at Albany, New York, and edited by Samuel Blydenburgh, Esquire.—

"By the improved system of winding silk, invented by Mr. *Gay*, many and important advantages are gained; but still it will not altogether supercede the use of the reel. By his plan the silk is wound on spools from the cocoons. In this state it is not liable to tangle as when in skeins. When once wound in a contiguous thread on the spools, it may be kept any length of time, and carried any distance, without injury. It will be in the same state of keeping, as the spools of cotton thread, and may always be wound off in the same entire thread as it was wound on.

When the silk is intended to be sold to the manufacturer even to the merchant, this is infinitely the safest way in which it can be preserved. When in the skein it is always liable to injuries, either in keeping or in trasportation.

If the silk is cultivated near to where it is to be manufactured, the manufacturer can furnish the spools, weighing them as they are delivered out, and deducting the weight of the spools when returned from the silk. If it is to go through several hands, the spools may be made of an exact given weight, and warranted not to weigh more.

The whole process of winding is, by this plan, not rendered much more simple and easy to learn, but is infinitely more convenient, as it will be done by a little snug machine, which will be no inconvenience at the fireside, while the regular silk reel is much more cumbrous and would scarcely find room in a small dwelling.

But in nearly all cases, where the silk is to be manufactured, it will still have to be reeled from these bobbins, or spools, into hanks or skeins. This, however, is no objection to winding it originally on spools, for the saving and other advantages which result from keeping and preserving the silk on spools, overbalance the trouble of two windings."

☞ We take pleasure in stating, that these machines may be obtained on application to *Samuel Blydenburgh*, Esquire, Albany, New York.

Speaking of the machinery of Mr. Gay and his partner, Mr. Moseley, Judge *Ambrose Spencer*, of Albany, New York, in a letter to Mr. A. H. Brown, of Frederick county, Md. makes the following remarks, which, through the politeness of the latter gentleman, we are permitted to copy:

"I am personally acquainted with Mr. Gay: he is, indeed, a very ingenious man: independent of the *reel* invented by him and Moseley, he, or they, have simplified all the machinery necessary for the manufacture of silk, and there is now in operation at Providence, under Mr. Gay's direction, a manufactory of silk, the stock in which has sold for more man 100 per cent., advance. He sent me a pattern for a vest, equal to any imported. He finds that the power loom, by which cotton has been woven, may be successfully used for the weaving of silk. Mr. Gay is the very man to give or furnish instruction in the art of *reeling*, and to establish a manufactory, furnishing all the necessary machinery."

And in addition to this high encomium upon the merits of Mr. Gay and his machinery, we have seen it stated, that his *reel* is so simple in its construction, as that any woman can acquire sufficient knowledge of its use, in two hours instruction, to become a tolerably expert reeler.

5. *Terhoeven's winding, doubling and twisting machine.* This is represented as a simple machine, invented by Messrs. Terhoevens, of Philadelphia, used for winding silk from cocoons, and for doubling and twisting the thread at the same time.

6. *Cobb's reel.* This is an invention of Mr. J. H. Cobb, of Massachusetts, and it is stated to be a most efficient machine, combining in an eminent degree simplicity with power.

There are many other reeling machines, of European and American inventions, as well as numerous silk looms, twisting machines, draw boys, ribbon looms, looms for weaving plain and figured stuffs, and power and other looms, and inventions, of one kind or another, out of number; but as our work is intended for farmers and planters, who, we presume, will scarcely ever carry the business beyond converting the cocoons into raw silk, we consider that, in noticing the machines herein recited, we have accomplished all that need be required by those for whose accommodation we have ventured to compile this work. Indeed, so far as the interests of the husbandman is concerned, except for the purposes of domestic use, such as sewing silk, knitting of stockings, and the fabrication of an occasional dress for the females of the family, we should doubt the propriety of his carrying the silk culture beyond the point of reeling. Having effected that, we think, he should be content to transfer the business of all subsequent labor upon the commodity, to the hands of the manufacturer,

leaving his *factor* to settle the questions with respect to who *that* should be,—or whether he should find for it a foreign or domestic market.

MARKET FOR THE SILK.

The disposal of the silk after it shall have been raised, being an object of the first importance, it seems opportune that we should say a word or two with respect to the markets. By a letter of Judge *Ambrose Spencer*, it is stated, that the import of silk amounts to the value of $10,000,000, *annually*, and as he very justly remarks, this will increase with our wealth and population. Thus we have a domestic market, to this enormous amount, inviting the American husbandman to supply it. And already various manufactories in the states of New York, Rhode Island, Connecticut, and Massachusetts, have been established, to convert the raw silk into stuffs of various descriptions, and so confident are the calculating people of that intelligent and enterprising portion of our country, of the entire and triumphant success of the silk business, that companies and individuals are in every direction of it, entering with spirit into the culture and manufacture of silk. Indeed, so rapid have been the multiplication of establishments for its manufacture, that the *demand* for the raw material, greatly exceeds the supply, *and at the present moment almost any quantity of cocoons or raw silk, would find a ready and profitable market*, in any of the principal eastern cities. The price of raw silk, we have seen quoted at $4 per pound, and that of *cocoons* at $3 a bushel. We have never counted the number of cocoons contained in a bushel; but from having measured and counted a quart, we should think that from 4,000 to 5,000, according to their size and perfection, would make a bushel of cocoons. The only thing like a calculation upon this part of the subject, that we have been able to lay our hands upon, we found in the very interesting letter of *William B. Buchanan*, Esquire, in which he speaks of 1,500 worms making *about three pecks of cocoons*. If *his measure* be the correct one, then, two thousand would make a bushel, but we incline to think that an *average*, of any *considerable quantity*, would take fully the number assumed by us.

Besides the domestic market just spoken of, *France imports* annually between $5,000,000 and $6,000,000 worth of raw silk, and this, too, notwithstanding she is a silk growing country. And *England*, owing to the humidity of her climate, being unable to raise the worms to advantage, has to draw all the raw material for her numerous silk manufactories, from distant countries, and we have seen the annual average amount consumed by them from 1821 to 1828, a period of 7 years, stated at $17,255,368. Thus then, in our home market, and in the markets of France and England, we find a demand for raw silk, annually, of about $33,000,000, which, as those countries respectfully expand in population and wealth, must increase in a correspondent ratio; and no one will pretend to affirm, that, if we supply the article upon as good terms as other nations, we will not have an equal chance with them in so doing. And here we would ask, what can prevent us, with our advantages of locality, of climate, extensive domains, and soil, from at once becoming successful rivals in every market where the raw silk material is demanded? There is nothing within the range of probability, that can operate unfavorably to our competition, unless, indeed, it be our own supineness—our culpable indifference—our criminal neglect—to add to our productions, a staple commodity, which will, if prosecuted with vigor and intelligence for ten years, equal, if it does not exceed, our exportation of cotton, without interfering in the least with its consumption. As it has been forcibly observed by Judge Spencer, our *import* of *silk stuffs* already exceed our entire *export* of *breadstuffs*. This is an important fact, because, with the facilities of manufacturing already established and being established, we have at our own doors, a market greatly exceeding in *demand* any *supply* which for several years the country will be able to furnish, and at prices too, which offer the most generous rewards to the labor of the agriculturist.

If it be said that these markets are to the *eastward*, remote from the great Mulberry regions of the middle and southern states, we affirm that agencies for the purchase of raw silk, will rise up in every district and city of those regions, so soon as the article shall be grown therein in sufficient quantities to make it an object. Therefore, no farmer or planter should permit such a thought to enter his mind, as there is nothing more certain than that *markets* and *capital* will *spring* up, and be *employed* wherever and whenever profit is to be made,—interest and emolument, being with merchants, as with every body else, the great ruling motives by which their actions are governed in matters of trade.

DISBANDING OF SILK FROM THE REEL.

The Treasury Manual has the following, and as we see it copied by the Silk Culturist, published at Hartford, Connecticut, by the Hartford county Silk Society, in the midst of the silk culture country, we take it for granted that it is the approved method.

"The single fibres of which the thread is composed, are liable to suffer very different degrees of stretching as they are wound from the cocoons. If the cocoons are not well sorted, this different degree of extension will be the greater; and even when they are sorted, they must still be subject to the same, because some are a little longer in the water than others, and, therefore give their silk easier; and also, the weak latter ends of some cocoons wind off with the strong first part of others. The fibres being thus stretched unequally, will occasion when the skein is taken from the reel too suddenly, those fibres which are most stretched to contract more than the others, by which their union will be in some measure destroyed, and the thread composed of them rendered less compact and firm, the fibres appearing in several places disjoined from one another. To remedy this, the skein should remain there six or eight hours, until the unequal extension which it suffered in winding is, by the stretch which it undergoes on the reel, brought nearer to an equality; and, until the thread, by being well dried, has its fibres firmly united. When the skein is quite dry, proceed to disband it from the reel. First, squeeze it together all around, to loosen it upon the bars; then, with a thread made of the refuse silk, tie it on that place where it bore on the bars of the reel: then slide it off the reel, and make another tie on the part opposite to the one first made; after which, double it, and tie it near each extremity, and then lay it by for use or sale, in a dry place. When the skein is finished, there should be a mark tied to the end of the thread, otherwise it may be difficult to find it, if it mixes with the thread of the skein.

CLEANSING AND UNGUMMING SILK.

"The operation consists of depriving silk of the principles which affect its whiteness.

Make up the silk into hanks, that is to say, run a thread around each hank, which consists of a certain quantity of skeins tied together. After that, the hanks are to be united, and several of them to be bound together, to make up a bundle, the sizes and names whereof vary according to the nature of the article manufactured.

After this operation, soap is to be dissolved in water, heated in a kettle in the proportion of 15 lbs. of soap to 100 lbs. of silk. Cut the soap into small slices to promote its solution. After the soap has been dissolved, the kettle is to be filled with fresh water, which should be pure, free from calcareous impregnation, but not in unnecessary quantities, in order to avoid increasing the

proportion of injurious salts, and weakening the force of the solvent. The proper proportions for this operation, as ascertained after many experiments on a large scale, are 7 or 8 lbs. of water, to 1 of silk—1-12 or 1-6 is sufficient for the greater number of colors: for yellow, unbleached silks, it is necessary to add from 50 to 60 per cent.; for unbleached white silks, 25 per cent. of soap. The water being in the kettle, the doors of the furnace closed, leaving only a few live coals in it, in order that the bath may be kept quite hot, but without boiling; for Dr. Bancroft says, that silk ought never to be submitted to a boiling heat, either when the mordant is applied, or afterwards in the dying operation, as a high temperature, besides injuring the texture and lustre of the silk, would detatch and separate the mordant, before the coloring matter could have combined, and produced an insoluble union with both. Those eminent French chemists *Thenard* and *Roard*, also confirm Mr. Bancroft's views.

Whilst this bath is preparing, the hanks are to be put upon the pegs or pins, and when the bath is ready, the silk is to be put into it, and left therein, until all the part dipped is wholly freed from its gum; which will be easily seen, by the whiteness and flexibility which the silk acquires when deprived of it. The hanks are then placed again on the rods, to undergo the same operation in the parts not yet steeped; they are then to be taken out of the bath, in proportion as they are found divested of their gum.

The silk, thus ungummed, is to be wrung upon the pins to remove the soap in it; then to be dressed, by being arranged upon the pins and upon the hands, in order to disentangle it; then a cord is to be run through the hanks, to keep them down during the boiling. About 8 or 9 hanks may be placed on a line. After this the silks are to be put into bags of strong coarse linen. These bags are to be put 14 or 15 inches wide and 4 or 5 feet long,—closed at both ends, but open lengthwise. When the silk is put in them they must be stitched up—each bag will hold 30 lbs. of silk.

The silk thus bagged is to be submitted to a similar soap bath, as above described, to undergo a boiling for a quarter of an hour; when it begins to boil over, it is to be checked by adding cold water. The bags during boiling must be often stirred to prevent the silk from burning. This operation is performed with silk intended to remain white.

BOILING SILK TO BE DYED WHITE.

For boiling silks intended for common colors, 20 lbs. of soap to 100 lbs. of raw silk. The process of boiling the same, as the first described, with this difference only, that as the silk is not to be freed from its gum, the boiling is to be continued three hours and a half, taking care to fill up from time to time with water.

If the silks are intended to be dyed blue, or iron gray, sulphur, or other colors, which require to be set in a very deep white ground, in order to acquire the desired beauty, there are to be used 30 lbs. of soap to 100 lbs. of silk, and the boiling to be continued three or four hours. After being supposed to be boiled enough, let the bags be raised with a stick, placed on a frame, and examined if there be any parts where the liquid has not penetrated. This is easily ascertained by the yellow and a certain kind of slime remaining on those parts. Should this defect be discovered, the bags of silk must be again boiled until it be remedied. The loss in boiling is about one-fourth in weight.

SULPHURING.

The silks to be sulphured, should be extended on poles, placed 7 or 8 feet from the ground, in a high apartment without a chimney, where the air may freely circulate by leaving the windows and door open. For every 100 lbs. of silk, take 1 1-2 pounds of roll brimstone, put it into an earthen pan or iron kettle, at the bottom of which a layer of ashes is to be placed; pound the rolls of brimstone coarsely; then set fire to it and smoke the silk during the night. The next day the door and windows are to be opened, to let the smell of the brimstone escape and dry the silk. If the silk should not thus be dried, apply live coals in chaffing dishes or some other convenience.

ALUMING.

After having washed the silks, and divested them of the soap by giving them a boiling, pass a cord through them as when they are to be boiled; then take 50 lbs. of alum, for 50 buckets of water—(dissolve the alum first in hot water,) stir it well on emptying the solution of alum into the tub, and it will prevent congelation. This bath will answer for 150 lbs. of silk to be steeped in it until the solution begins to have a fetid smell. The silk should not be put in until it is perfectly cold. If the alum water should appear too weak, more alum is to be added.

PROCESS OF DYING SILK.

A HANDSOME YELLOW.

[Note.—The following receipts are proportioned to 10 lbs. of silk previously boiled.]

Take 1½ lb. of alum
20 lbs. common Lady's (St. Mary's) Thistle
½ lb. wood ashes.

Dissolve the alum in a kettle containing ten buckets of water, pour the solution into a vat, fix your silk upon rods, in the usual way, steep it in the solution, work it well therein for an hour, take it out, and lay it aside wet, for further use.

This being done, put ten buckets of water in a kettle, add the St. Mary's Thistle, and boil it well for a quarter of an hour, run the decoction through a sieve into a pail, to separate the coarse parts from it; let it cool, until you will be able to bear your hands in it, steep the silk in the liquor, work it well therein for half an hour; then take it out, wring it, and lay it aside, in its wet state for further use.

The pails or vessels in which you dress the silk with alum, and in which the liquor is, must be filled, and kept full, during the process of working it, to within a few inches of the top; and, should there be occasion to fill up, or to increase the quantity of liquor with water, care must be taken not to make it too cool, but to preserve, at all times, a degree of heat, in which the hand can be barely held. While this is doing, the St. Mary's thistle must be put into the kettle a second time, with fresh water, and be boiled again. Then take out the silk, dip out some of the liquor, in which you had previously worked the silk, and add as much of the liquor of the second boiling to it as was taken therefrom, so that the first quantity will be preserved. The liquor must now, as well as each time before you steep the silk in it, be stirred well; then steep the silk in the liquor again, and work it well therein for half an hour.

The liquor may, in this latter process, be made a little hotter than it was in the first; but be cautious not to make it too hot, as the silk would be considerably injured thereby.

During this second process the wood ashes are to be dissolved in a kettle, into which you have poured some of the liquor of the second colouring, boiling hot; stir the liquor and wood ashes well, and then let it settle. This being done, pour some of the clear part of the solution into the yellow liquor, after having first taken out the silk, stir the whole of it well, steep the silk in it again, and work it well therein during fifteen minutes. At the expiration of this time, or sooner, as you may deem it necessary, take out a small quantity of the silk, wring it, and examine whether it has retained the required colour; should this not be the case, a small quantity of the solution of wood ashes must be added to

the liquor, the silk steeped in it again, and well worked in the same, until the required colour be obtained.

A CITRON YELLOW.

Take 1 1-4 lb. of alum
8 lbs. of safflour
1-4 lb. of alum.

Dissolve the alum in a kettle containing ten buckets of water; then pour the solution into a vat, steep the silk in it, work it well therein for half an hour, wring it, lay it by in its wet state, for further use, and throw away the solution of alum as useless. Put again ten buckets of fresh water in the kettle, add eight pounds of safflour and 1-4 lb. alum, let it boil for half an hour, run the solution through a sieve into a vat, steep the silk in the liquor, work it well therein a quarter of an hour, wring and dry it, fix it on the wringing post, wring and beat it well.

With the rest of the above liquor, a pale yellow may yet be dyed.

A CITRON YELLOW, which may be heightened to a handsome gold tint.

Take 1 1-4 lb. of alum,
14 lbs. of safflour,
1-4 lb. of alum,

Put ten buckets of water in a kettle, add one and a quarter pounds of alum, dissolve it therein, pour the solution into a vat, and work the silk in the solution for about half an hour, wring it, and lay it by in its wet state, for further use.

This being done, pour ten buckets of fresh water into the kettle, add seven pounds of safflour, and boil it half an hour, pour the liquor through a sieve into a vat and work it well therein for the space of fifteen minutes; then wring and dry it. The yellow liquor is now to be poured back into the kettle, the remaining seven pounds of the safflour to be put into it, together with a quarter of a pound of alum, and the whole to be boiled half an hour; then pour the liquor through a sieve into a pail, work the silk well in the liquor for half an hour, wring and dry it and then beat it well. By the above process, a handsome citron yellow may be obtained.

A CITRON YELLOW, in a different way.

Take 1 1-4 lbs. of alum,
7 lbs. of French berries.

Put the alum into a kettle, with eight buckets of water; when dissolved, pour it into a bucket, immerse the silk in the solution, work it well therein for half an hour, take it out, and lay it aside for further use in its wet state, and throw away the solution. Then boil ten buckets of fresh water, put into it the French berries, boil it for three quarters of an hour, pour it through a sieve into a bucket, and immerse it in the liquor, work it well therein for half an hour, wring it, fix it on the wringing post in the usual manner. To make this color deeper or brighter, take more or less than the above quantity of the French berries.

If the liquor, after this process, still retains some of its yellow properties, it may be used to color ten pounds of silk, previously prepared in a solution of alum, to a pale yellow, or to lay at least the ground for a handsome gold tint.

A CITRON YELLOW, in another manner.

Take 2 lbs. of alum,
6 lbs. of Quercitron bark, ground.

Put the alum in a kettle, with ten buckets of fresh water, dissolve it therein, and pour the solution into a vat, immerse the silk in it, and work it well therein for two hours; wring it, lay it aside wet for further use, and throw away your solution of alum as useless. Then pour into a kettle ten buckets of fresh water, and put the ground Quercitron into it; boil this one hour, take it out, run the decoction through a seive into a pail, immerse it into the liquor, and work it well an hour in the solution; after which it is to be taken out, wrung and dried; fix it on the wringing post, wring it again, &c., when it will have acquired a beautiful citron yellow. The remaining yellow liquor may be used for other purposes, and may therefore be preserved. I will now give the necessary direction for coloring a handsome pale yellow, with the above remains of the yellow liquor.

A PALE YELLOW.

Take 2 lbs. of alum.

Prepare the silk with alum, as directed in the foregoing receipt, and lay it away for further use. Then warm the liquor, which has been used in the coloring of the foregoing operation; put it into a pail, immerse it in the liquor, and work it well therein, for the space of half an hour. This being done, take it out, wring it, fix it on the wringing post, wring and beat it well, which will give it a gloss. It is not necessary that silk should be rinsed in yellow coloring.

Several Directions for Dying with QUERCITRON BARK.

A CITRON YELLOW.

Take 3 lbs. of alum, and
1 lb. 3 ounces of Quercitron bark.

Put the alum in a kettle, with ten buckets of water; let it dissolve therein, pour the solution into a pail, immerse the silk in the solution, and work it well therein, a little longer than usual; take it out, wring and rinse it, and lay it by for further use, in its wet state; put ten buckets of fresh water into a kettle, warm it, put the quercitron in a bag, and boil it until the strength is extracted. Then immerse the silk in the liquor, and work it well therein a quarter of an hour, which will produce a handsome lively citron yellow.

A HIGH COLORED YELLOW.

This color may be heightened to its utmost extent of yellow, by adding a few half ounces of soda, more or less, according to the deep or bright shades of color desired, to the above yellow liquor; but this must not be done until the silk has been completely saturated with the yellow liquor of quercitron.

ORANGE COLOR.

Orange color is obtained by adding to the liquor at the same time with the soda, a proportional quantity of annatto, and by working it in this liquor until the desired color has been obtained.

PALE YELLOW, OR STRAW COLOR.

Take less alum and quercitron, and dispense altogether with the soda and annatto.

BUFF.

To produce the many different shades of this color, proceed with the quercitron in the same manner as directed in the dying of the same colors with turmeric and wild (dyer's weed.) But you must bear in mind that one pound of the quercitron, will produce as much as ten pounds of either the turmeric or wild.

A VERY LIVELY GLOSSY YELLOW.

If you desire to increase the above yellow to its most lively and glossy hue, take instead of the alum, a solution of tin, dissolved in a mixture of three parts of the spirits of salt, and one part of aquafortis. This solution must be mixed with twenty times its own quantity of water, and the silk is to be prepared in a solution of alum, in the usual way; but it is not necessary to rinse it, and it may be colored immediately. The solution of tin may be preserved for other purposes.

A TURKISH BLUE.

Take 2 1-2 ounces of cochineal,
10 do of aquafortis,
1 1-2 do of English tin and
1-4 do of alum.

The silk must first be colored in a keep, to a medium blue. This being done, take a kettle containing ten buckets of water, put into it two and a half ounces of cochineal, and boil it well for the space of ten miuutes.

During the above process, dissolve the tin in the aquafortis, according to art. This being done, pour the solution, together with a quarter of a pound of alum, into the above mentioned kettle, with ten buckets of water. Stir the liquor well, and immerse the silk in the liquor, work it well therein, for about three quarters of an hour; during which time, it must be kept at a steady, slow, continued boil; then take it out, rinse it, fix it on the wringing post, wring and beat it well; which will restore it to its natural gloss again.

A REAL PINK.

Take 15 lbs. of safflower,
15 quarts of strong vinegar,
3-8 of an ounce of oil of vitriol,
1 lb. 14 oz. potash, and
4 ounces of cream of tartar.

Put the 15 lbs. of safflower in a bag, tie it tight, immerse it forty-eight hours in running water; take it out, during this time, every six hours; tread it well with your feet, to free it of all yellow matter; continue this until all the yellow matter has been worked out of it. Examine it at the expiration of the above time, to see whether it has lost all its coloring matter; if it has not, immerse it a few hours more into the water, which will clear it from all yellow matter. This being done, take it out, put it into a pail, and pour six buckets of river water upon it.

This being done, put one pound fourteen ounces of potash in a crock, dissolve it in water, and pour the clear part of this potash liquor on the safflower in the tub; mix it well, and set it by, in a cool place, for six hours. At the expiration of this time, take out the safflower with its liquor, run it through a sieve into a pail, pour half a bucket of water upon it, and press it out, in order to extract all the coloring matter therefrom; pour fifteen quarts of vinegar, and three-eighths of an ounce of oil of vitriol into the liquor.

This being done, take the ten pounds of silk, fix it upon the rods, put it into the safflower liquor, and work it well therein, for the space of four hours; then take it out, rinse it in running water, wring it well, and lay it aside for further use, in its wet state.

Lastly. Dissolve four ounces of cream of tartar in river water, and pour the clear part of this solution into a tub, with eight buckets of river water; immerse the silk, which has before been colored to a light red, in this solution, and work it well therein for a quarter of an hour; take it out, wring it and dry it, and you will have a handsome pink.

A HIGH COLORED CRIMSON.

Take 1 1-4 lbs. of cochineal,
1 lb. of galls,
4 ounces of cream of tartar, and
2 1-2 lbs. of Roman alum.

Dissolve two and a half pounds of Roman alum in a kettle, with ten buckets of water; pour the clean part of this solution into a vat, immerse the silk in it, and work it well therein for the space of four hours; and rinse it in running water, wring it, and lay it by for further use, in its wet state; then put in a kettle containing eight buckets of boiling water, the following articles:

One and a quarter pounds of finely powdered cochineal, one pound of finely powdered gall-nuts, and four ounces of cream of tartar. Let the whole boil slowly, for the space of fifteen minutes; cool it with two buckets of water, work it well in the liquor, which must be kept in continual boil for the space of one hour and a half; then take it out, rinse it, wring it, and let it dry, when the dying will be completed.

For a cheaper color than the foregoing, reduce the quantity of cochineal, from one and a quarter pounds, to ten ounces, and substitute for the remainder, three pounds persio;* and proceed with these materials in the same manner as above directed. This color will differ from that of the first described process, in no other respect than that it receives somewhat more of a bluish cast.

A HANDSOME CRIMSON.

Take 3 lbs. of Roman alum,
1-2 ounce of argol,†
1-2 of East India galls,
25 ounces of cochineal.

Heat eight buckets of rain water in a kettle lukewarm; put into it three pounds of Roman alum, dissolve it therein, take out the solution and work it well therein for the space of eight hours.

Take it out at the expiration of this time, wring it lightly, and lay it by for further use, in its wet state. To complete this color, heat eight buckets of well or spring water until it begins to boil; put into it the following articles: half an ounce of argol, and half a pound of finely powdered East India galls; let the whole of these articles boil well for about ten minutes, and run the liquor through a sieve, into a pail; then pour the liquor back into the kettle, and put into it twenty-five ounces of pulverized cochineal; let it boil ten minutes more, cool the liquor with half a bucket of water; immerse the silk in this liquor, and work it well therein for the space of two hours; during which time, the liquor must be kept at a continual boil. This being done, take it out, rinse it well, wring it strongly, and dry it.

Then take a kettle, with ten buckets of spring or well water, and heat it so that you may bear your hand in it; work the silk well in this water for half an hour, then take it out, wring it, and dry it. By this process, we obtain a very handsome crimson.

A DEEP RED.

Take 1 lb. of fine galls,
2 1-2 lbs. of alum,
1-2 lb. of composition, and
5 lbs. of madder.

Put into a kettle eight buckets of water, and one pound of fine galls; let it boil about fifteen minutes, or until the strength is extracted; take it out, run it through a sieve into a vat, steep the silk in this decoction, and work it well therein for about two hours: after which take it out, rinse, and dry it. Then put into a kettle eight buckets of water, with two and a half pounds of alum, and a half pound of the composition; let these be properly united with the water; pour the liquor into a vat, steep the silk in the solution, and work it well therein for the space of four hours; take it out, rinse it, and lay it by in its wet state for further use.

Lastly. To complete these colors, put in a kettle ten buckets of water; add five pounds of madder, and work the silk well in this liquor, until it begins to boil; then take it out, rinse and dry it.

A REAL BROWN.

Take 6 ounces of annatto,
1 lb. of potash,
3 lbs. of alum,
5 oz. of fine galls,

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* The cudbear of the English dyer.
† Tartar from red wine.

1-4 oz. of cream of tartar,
2 oz. of turmeric, and
10 oz. of cochineal.

Boil a kettle with ten buckets of water, powder six ounces of annatto, and put it together with a pound of potash into the kettle, boil for a quarter of an hour, pour the liquor through a sieve into a tub, immerse the silk, and work it well in the liquor for the space of two hours; then take it out, rinse, wring and dry it. After this, pour eight buckets of fresh water into a kettle, add three pounds of alum, and dissolve it therein; then put the solution in a vat, steep the dried yellow silk, and work it well therein for the space of three hours, then take it out, wring it, and lay it by wet, for further use.

This being done, prepare a kettle with eight buckets of water, and bring it to boil; put into it ten ounces of cochineal, and let it boil for ten minutes; then cool the liquor with a bucket of water, and put into it a quarter of a pound of cream of tartar, and two ounces of turmeric, and stir the whole well; then steep the silk, previously alumed in the liquor, work it well therein for the space of two hours, during which it must be kept at a continual boil. This being done, take it out, rinse in running water, wring, and lay it by, in its wet state, for further use.

This being done, dye it in a keep, [dye tub,] light or dark as your taste may be, or according to the pattern which is laid before you.

If you do not wish to make use of the keep, or, as is often the case in small dying establishments, should you not possess one, you may apply the indigo coloring.

You may likewise color it in the liquor of logwood, which will render it equally handsome, but not of so lasting a color.

A REAL CRIMSON, in another way.

Take 2 1-2 lbs. of Roman alum,
2 lbs. of fine galls,
1 lb. 4 oz. of cochineal,
1-4 lb. of argol, and
8 oz. of spirits ammonia.

Take a kettle with eight buckets of water, put into it two pounds of fine galls, and let it boil for a quarter of an hour; run the liquor through a seive into a pail; steep the silk in the liquor, and work it well therein for the space of four hours, then take it out, rinse, wring and dry it.

After this, take a kettle with eight buckets of water, and dissolve in it two pounds of Roman alum; pour it into a vat, steep the silk in the solution of alum, and work it well for the space of four hours in the same; then take it out, wring it, and lay it by, in a wet state, for further use.

After this, to complete the color, take six buckets of water, pour it into a kettle, add one pound and four ounces of fine cochineal, a quarter of a pound of argol, and eight ounces of spirits of ammonia; let all boil well together for about ten minutes, then cool the liquor with two buckets of water, work the silk well in it for two hours; during which time it must be kept boiling continually; then take it out, suspend it on the rods over a vat, pour the liquor from the kettle into it, and continue to work the silk in the liquor until it has become cool, then take it out, rinse it and dry it in the shade. By following the above directions, you will obtain a very handsome crimson.

To turn this expensive cochineal liquor to all possible advantage, (for it will still have retained some good coloring matter,) pour the above used alum liquor into it, and heat it again; which will enable you to color many lighter shades, from the rich peach blossom, down to the lightest lilac color. Having used it for this purpose, you may take more or less of silk of a yellow ground, and color it in it, which will receive a reddish yellow from it.

A HANDSOME RED.

Take 8 oz. of annatto,
1 1-2 lbs. of potash,
2 1-2 lbs. of alum,
6 lbs. of Brazil wood,
5 buckets of sharp vinegar, and
6 oz. of composition, composed of the following materials: 1 lb. of spirits of nitre, 2 oz. of sal ammonia, 6 oz. of grain tin. The tin and ammonia, are to be put into a sand stone pot of sufficient capacity; upon these pour about 12 oz. of water, then add the spirits of nitre and let the solution take place.

Take for this purpose a kettle with eight buckets of water, and let it boil.

While this is doing, powder eight ounces of annatto as fine as possible; then put it together with one pound and a half of potash, into the above heated water; let the whole boil well for a quarter of an hour; and pour the liquor through a seive into a pail. Steep the silk in this potash and annatto liquor, and work it well for two hours in the same; after which take it out, rinse it, wring and dry it.

Then dissolve one pound and a half of alum in a kettle with eight buckets of water; pour this solution into a pail, fix your silk upon rods, and work it well therein for two hours; then take it out, wring, and dry it.

When the silk is completely dry, steep the silk in warm water, until it has become properly soaked; then take it out, wring it, and lay it by for further use.

This being done, pour into a vat five buckets of sharp vinegar, and six pounds of Brazil wood, and let it stand for the space of forty-eight hours; then take the liquor out of the vat and pour it into a kettle; let it boil for the space of ten minutes; then take it out, pour it through a seive into a vat, and through the parts remaining in the seive, in the kettle again; pour three buckets of water upon it, let it boil well for a quarter of an hour, and pour the liquor thereof to the other Brazil wood liquor in the vat.

This being done, pour six ounces of the composition into this liquor of Brazil wood, and stir it well; steep the silk previously soaked in warm water, in the liquor, and work it well therein for the space of two hours. Examine at the expiration of this time, whether the liquor still contains any coloring matter; if so, take it out, pour it into the kettle again, work the silk another time therein, during which it must be kept moderately warm; then take it out, rinse it in running water, wring it, and hang it up to dry. By observing the whole of the above process, you will obtain a very handsome red. By using eight buckets of vinegar instead of five, the color will be considerably improved, and by dispensing with the composition altogether, the color will become darker.

Lastly. If you desire to have this color of a darker fiery hue, add two pounds of Brazil wood, and one pound composition to the above quantity, and proceed in the same way as above directed.

To Color Silk with Quercitron, in another manner.

A CITRON YELLOW:

Take 2 1-2 lbs. of alum,
4 lbs. of sugar of lead,
2 oz. of chalk, and
3 lbs. of Quercitron.

Take a kettle with eight buckets of water, put into it two and a half pounds of alum, and dissolve them therein, then take out the alum liquor, and pour it into a pail,

and let it become cold, add to it a quarter of a pound of sugar of lead, and stir it well until united with the solution of alum, then put into it two ounces of chalk, stir it well, and continue the stirring at proper intervals, for the space of twelve hours, and sit it by to settle. Pour off the liquor into a pail, but be careful not to disturb the sediment at the bottom; steep the silk in the liquor, and work it well therein for the space of six hours; then take it out, wring and lay it by wet, for further use.

After this, take a kettle with eight buckets of water, put into it three pounds of Quercitron bark, and let it boil for the space of three quarters of an hour; pour it through a sieve into a vat, steep the silk which has been saturated in the foregoing liquor, composed of alum, sugar of lead, and chalk, in the Quercitron liquor, and work it well for the space of an hour; then take it out, rinse it, wring and dry it.

If you desire a higher colored citron yellow than the above, add another pound of Quercitron to the above quantity, and proceed in the following manner:

Saturate the silk, as above directed, in a liquor of alum, sugar of lead, and chalk, then take a kettle with eight buckets of water, boil two pounds of Quercitron therein, for the space of three quarters of an hour, and pour the liquor through a sieve into a vat, steep the silk and work it well therein for the space of two hours; after which, take it out, wring and dry it. This will have given the silk the best of grounds for a good yellow color. After this, take another kettle with eight buckets of water, put into it two more pounds of Quercitron bark, and boil it for the space of three quarters of an hour; then pour it through a sieve into a vat, and work the previously coloured and dried silk in the same, for the space of two hours; then take it out, rinse it, wring and dry it.

A HIGH COLORED AND DEEP CITRON YELLOW.

Take 1 1-2 lbs. alum,
3 oz. of sugar of lead,
1 oz. of chalk, and
8 lbs. of French berries,

Dissolve in a kettle which contains eight buckets of water, one and a half pounds of alum, pour the solution into a pail, or which is better, into a cask, and let it cool. This being done, put into it three ounces sugar of lead, stir it well with a rake, add one and a half ounces of freely powdered chalk, and stir the whole well again and continue the stirring, every hour, for twelve hours. But, after the last stirring, the rake must be taken out of it, to prevent the sediment from being disturbed, and then let it stand twelve hours. At the expiration of this time, draw off the liquor; but be careful not to disturb the sediment, which would otherwise create stains that are difficult to remove; pour the liquor, thus drawn off, into a vat, work the silk well in it for the space of four hours, after which, take it out, wring and dry it. This being done, moisten it with warm water, rinse it in running water, wring it and lay it by wet, for further use; then take a kettle with eight buckets of water, and at the same time, bruise eight pounds of French berries in a mortar; put them into the kettle, and let them boil for half an hour: then take out the liquor, and run it through a sieve into a vat. This being done, steep the silk in the liquor, and work it well therein for half an hour; take it out, wring and dry it; which produces a handsome citron yellow.

With the above used alum solution and French berry-liquor, you may without any other addition, colour a brighter citron yellow. The same solution may likewise be applied with turmeric or weld, in dying.

A NANKEEN.

Take 2 lbs. of fine galls,
1 1-2 oz. of annatto,
4 oz. of potash, and
1-2 lb. of soap.

Put one pound of finely powdered galls in a kettle of eight buckets of water, and boil it about ten minutes, then take out the liquor, and run it through a sieve into a pail. While thus employed, let half a pound of soap be dissolved in a bucket of warm water, and pour the solution into the liquor of the galls. Then put into a crock with water, one ounce of annatto, and four ounces of potash; boil it for half an hour, add the one half of it to the liquor of the galls in the pail, and stir the whole well. This being done, steep the silk in the liquor, and work it well therein for a quarter of an hour. Examine the silk, and should it not have the necessary redness, add as much of the annatto liquor to it as you may deem necessary to give the colour the desired tint. Then put the silk in again, and work it well for a quarter of an hour; take it out, rinse and dry it.

The Nankeen coloured silk must not remain long without being rinsed, as this would create stains in it.

A HANDSOME TURKISH BLUE.

Take 1 1-4 lb. alum,
2 1-2 oz. of cochineal,
3-4 of an ounce of indigo,
3 oz. of oil of vitriol, and
1-2 lb. of composition.

The silk, after being boiled in soap and water, must be rinsed in running water, and then wrung and well beaten. This being done, it must be colored to a handsome light blue, in a cold or warm keep; then rinse it in running water, wring and dry it.

As soon as the silk has become properly dry, it must be moistened in warm water, wrung and laid by wet, for further use.

After this is done, prepare a kettle with eight buckets of water, dissolve in it one and a quarter pounds of alum, pour the solution into a vat, steep the silk in it and work it well therein for the space of an hour, then take it out, wring it, and lay it aside, in its wet state, for further use.

Lastly: take a kettle with eight buckets of water, boil it and put into it two and a half ounces of cochineal: let it boil for about ten minutes; cool the liquor, with a bucket of water, and add half a pound of the solution of tin, and three quarters of an ounce of indigo, which has been previously dissolved in three ounces of oil of vitriol, and stir the whole well. This being done, immerse the silk coloured blue in the cochineal liquor, work it well therein, until the liquor begins to boil, let it boil another hour, during which time the silk must, however, be continually worked, it must then be taken out, rinsed, wrung, and dried.

If you desire this Turkish blue to incline more to a red, take more of the cochineal: if the contrary, take less.

A HANDSOME GREEN.

Take 2 lbs. of alum, and
4 lbs. of Quercitron bark.

Take for this purpose, a kettle with eight buckets of water, and dissolve in it two pounds of alum; then pour it into a tub, and set it by until it is wanted.

While you are engaged in preparing the above solution, the silk must be colored in a cold keep to a handsome light blue, and after being rinsed in a stream, wring and steep it in the above-mentioned alum liquor; work it well therein for two hours, then take it out, wring it and lay it by wet for further use.

Lastly, put four pounds of Quercitron bark into a ket-

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ERRATA.—In the 7th line of the first column of the Historical Sketch, insert "*as*" instead of "*which*," so as to read "*as were accessible to him.*"

In the 37th page, last line of the second column, after the word cocoons read "2,400," instead of "24,000."

Entered according to the Act of Congress in the year 1835.

By EDWARD P. ROBERTS,

In the Clerk's office of the District Court of the District of Maryland.